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Edited by
ALBRECHT GOETZE, *Yale University*
THORKILD JACOBSEN, *University of Chicago*
ABRAHAM SACHS, *Brown University*

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A SURVEYOR'S MAP OF A FIELD

FERRIS J. STEPHENS

Yale University

New Haven, Conn., U.S.A.

So far as the writer knows, no detailed discussion of the text *YBT* I, 22 has ever been published. The occasion to do so now, arose when the Librarian of the Peabody Institute Library in Baltimore requested the use of the original object for a public exhibition. If anyone has tried to interpret the mathematical calculations involved, he must have found it inexplicable; because, as a collation of the original object shows, the text of the obverse as published in *YBT* is at fault in a few important particulars. This paper will serve, then, not only to interpret the piece, but to correct the published text. A new copy of the obverse of the text is presented with this paper (fig. 1).

It will be best to begin by translating the reverse. It reads: *4 bur 2 iku, ^{d}Nin-ur$_4$-ra, a-šà e-gú-ru-a, lugal-e á-na in-gíd, mu ^{d}Bur-^{d}Sin lugal-e Ur-bí-ì-lum^{ki} mu-ḫul*, '4 bur 2 iku of land, belonging to the goddess Ninurra, the field Egurua, the king by his authority caused to be surveyed. The year Bur-Sin the king destroyed the city of Urbilum.' The final line furnishes the well known date formula of the second year of the king Bur-Sin, the third king of the Third Dynasty of Ur.

The goddess to whom this tract of land belonged was the consort of the god Shara, the principal god of the city of Umma. The main deities of each city had lands assigned to them, the income of which supported their temples. The fields of Ninurra are frequently mentioned in the economic texts of this period. A useful collection of references to these fields is found in N. Schneider, *Die Götternamen von Ur III* p. 65. It is certain, then, that the field shown on our map was located in the territory of the city of Umma. Further definition of the location of the land is furnished by the name 'the field of Egurua.' In this respect the text follows the pattern of a similar piece, published in *RA* 4, 13ff., and *Journal des géomètres et experts français*, 1928, pp. 101 ff., where the land in question is said to be the 'field of the village of Shulgi-sib-kalama.' In our case, however, the name assigned to the field is not that of the village, or of a person, but probably that of a small irrigation ditch which watered the field. In fact the first element in the name (*e*) means an irrigation ditch with its accompanying bank of earth; hence we may perhaps interpret the line as 'the field of the irrigation ditch Guru.'

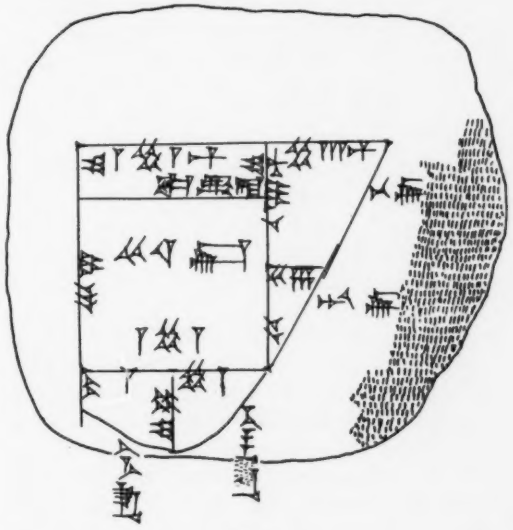

FIG. 1

In order to understand the method and purpose of the survey it is necessary first to draw a map which is true to scale and which uses the dimensions given on the tablet. Fig. 2 is such a drawing, for the drafting and lettering of which I am indebted to my friend, Richard S. Kirby. It will be seen at once that Fig. 2 represents in a general way the approximate shape of the outer boundaries of the drawing on the tablet, but that the original is by no means drawn to scale. Some of its longer dimensions have been foreshortened, probably for accommodation to the

space available on the tablet. The drawing on the tablet probably served approximately the same purpose as a modern surveyor's field notes, which are often not to scale. We are assuming that the surveyor had the points A, D, E, F, G, and H fixed on the ground and that the lines connecting these points marked the boundaries of the land. Because it was simple to compute the area of rectangles, right-angled triangles, and trapezoids, we assume that he proceeded in the field to subdivide the land into a series of such figures. We are also assuming that the angle at A was a right angle. We think he then fixed the points B and I so that the line BF would be perpendicular to AD, and the line IF perpendicular to AH. Having determined these auxiliary lines he fixed points L and M so that LE would be perpendicular to BF, and MG perpendicular to FI. Theoretically he had now divided the land into rectangles, trapezoids, and right-angled triangles. It was then only necessary to measure certain sides of these geometrical figures in order to be able to calculate the area. The measurements as recorded show that the effort to construct the figure ABFI as a rectangle was not quite successful because the opposite sides are not quite equal.

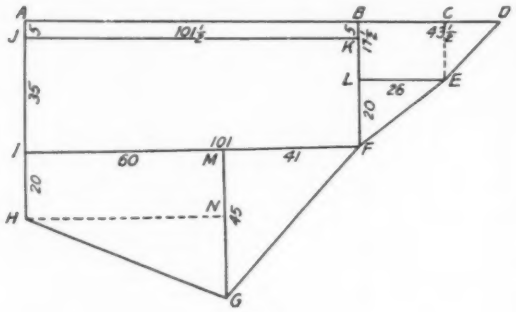

FIG. 2

Comparing the scale drawing with the *YBT* copy of that on the tablet we may point out the following necessary corrections to the *YBT* copy: the lines MG and LE are not shown in the copy, although they appear on the original; the length of line AB, shown in the copy as 41½, should be 101½, since a vertical stroke representing 60 is omitted before the sign for 40 in the copy; the length of line MF probably should read 41 instead of 40, since a partially obliterated vertical stroke follows the sign for 40, and since the full length of line IF is given as 101; on the original, just above the line corresponding to JK, is written in small characters the word *inim-gál-la*, which does not appear in the copy.

The purpose of the survey seems not to have been to determine the boundary lines, which are taken for granted, but to calculate the area within the accepted boundaries. This becomes evident when we realize: that the lengths of fully half the lines constituting the perimeter of the tract are not given; that the irregular plot is divided into right-angled triangles and quadrilaterals the area of which could be calculated by well known rules of mensuration; that of the four outside lines the lengths of which are not given, each constitutes the diagonal of a geometric figure the area of which could be calculated without the length of the diagonal; that the only outside dimensions given are not given as a whole, but in segments each of which forms a side of an inner figure the area of which it is thus possible to calculate. We may suppose that the object was to furnish a sound and authoritative basis for administering the cultivation of this land. The temple authorities had to know the area in order to be able to assign the proper quantity of seed grain, and to collect the proper amount of harvest from its cultivators. This field was a significant part of the lands administered by the temple; because its 4 bur 2 iku would be equal to an area of about 68 acres.

The total area is given in the first line of the reverse. This we may expect to represent the total of the various areas indicated on the detailed drawing of the obverse. We find on the original, six separate but contiguous figures, represented on our drawing as follows: 1, ABKJ; 2, JKFI; 3, IMGH; 4, MFG; 5, LEF; 6, BDEL. All but the first of these figures is supplied on the original with numerals showing their areas. Instead of being told the area of ABKJ we are told that it is *inim-gál-la*. This Sumerian word is translated in Akkadian as *puqurrūm*, or *rugummūm*; it is a term used in economic texts when there is a question of title to property; it means someone has some legal claim on this piece of land. It was included in the map because its dimensions were known and helped to supply the necessary data for calculating the area of the rest of the tract; but its area is not included in the total,

because it was 'claimed' by someone else. If we add the five indications of area we get exactly the total given in line 1 of the reverse, thus:

JKFI:	2 *bur* 1 *ubu* 1 DIŠ	= 3675 SAR[1]
IMGH:	1 *bur* 1 *iku* 1 *ubu*	= 1950 SAR
MFG:	1 *eše* 3 *iku* 1 DIŠ	= 925 SAR
LEF:	2 *iku* 1 *ubu*	= 250 SAR
BDEL:	1 *eše*	= 600 SAR
		7400 SAR = 4 *bur* 2 *iku*

We must now show how the area was computed in each of the five parts of the field. First we must realize that the dimensions of the figures are given in units of length known in Sumerian as GAR, a measure of about 20 feet. The square GAR, about 400 square feet, was known in Sumerian as a SAR. The average layman today, if confronted with the problem of calculating the area of the trapezoids IMGH and BDEL, would probably draw the dotted auxiliary lines HN and CE in order to be able to calculate separately the areas of the figures thus formed. The fact that the ancient surveyor did not draw these lines makes it apparent that he knew and used the rule that if one side of a trapezoid is perpendicular to the two parallel sides, the area is computed by multiplying one half of the sum of the parallel sides by the perpendicular side. Thus, $60 \times \left(\frac{45 + 20}{2}\right) = 1950$. This is exactly the number of SAR given on the tablet opposite the figure represented by our IMGH.

For the rest of the figures, however, the area given on the tablet is not exactly that which results from calculations, using the dimensions given. For example, the area of MFG by calculation is 922½ SAR, while the area given opposite this figure on the tablet reduces to 925 SAR. It was not customary to use units smaller than the *iku* in giving the area of tracts of land as large as that involved here. Fractional parts of an *iku* were often indicated as one-half, or one-quarter *iku*; but nothing smaller than one-quarter *iku* (25 SAR) is used in the notations of this text. Hence the nearest approximation to the actual area of a right-angled triangle such as MFG was 9¼ *iku* (925 SAR), as given in the text. Perhaps the surveyor realized that his figure may not have been an exact right-angled triangle; and hence the approximation was not unreasonable.

If LEF is a right-angled triangle its area, according to the dimensions given, would be 260 SAR. The nearest approximation to this amount, which can be written with the one-quarter *iku* as the smallest unit, is 2½ *iku*; and this is what the text shows.

The area of the trapezoid BDEL, calculated by the same method as for IMGH, is 608 SAR, 7¼ *gin*. The text records merely 1 *eše*, which again is the nearest approximation possible with one-quarter *iku* as the smallest unit.

This leaves only the area of the quadrilateral figure JKFI, which presents a little more difficulty. We know from several sources that the method in use by the Babylonian mathematicians for such problems was to multiply the mean length of two opposite sides by the mean length of the other two opposite sides. The simplest illustration of this method is shown by the two tablets YBC 7290 and 11126, as explained in *MCT* p. 44. It is further illustrated by YBC 4675 and 9852, discussed in *MCT* pp. 44–48. In all these cases the figure involved is a trapezoid. In *YBT* I, 21, however, we have a figure with no two sides parallel, or a trapezium. Here the upper side is given the length 200, and the lower side 160. The left side is 100, and the right side 80. The mean length of the upper and lower sides is thus 180; while the mean length of the right and left side is 90. The product of these two means is 16200, which is exactly the number given in the middle of the trapezium, if that sexagesimal number is interpreted as 4,30,0. All of these texts indicate that the method of finding the area of any four-sided figure, regardless of whether any two sides are parallel, was that mentioned above.

Our figure JKFI, while probably meant to be a rectangle, actually turned out to be a trapezium, as shown by its dimensions. Applying the method of taking the product of the mean lengths of the two pairs of opposite sides, its area should be 3417 $\frac{3}{16}$ SAR. The amount given by the text for this area reduces to 3675

1. The following table gives the well known values of the units of area measurement in the time of the Third Dynasty of Ur.

1 *bur*	= 1800 SAR
1 *eše*	= 600 SAR
1 *iku*	= 100 SAR
1 *ubu*	= 50 SAR
1 DIŠ	= 25 SAR

SAR. The difference between the calculated amount and the recorded amount is too great to be accounted for by the approximation involved in the recording. We reach our calculated amount on the assumption that the length of the line FK is determined by FL (20), plus LB ($17\frac{1}{2}$), minus KB (5), or $32\frac{1}{2}$. If we suppose that the original calculator made the mistake of failing to subtract the length of KB, he would have found $37\frac{1}{2}$ as the length of FK. Revising our calculation, and using $37\frac{1}{2}$ instead of $32\frac{1}{2}$, the result is $3670\frac{5}{16}$ SAR, which is so close to the recorded 3675 SAR, that we must suppose the original calculator made the mistake just mentioned. Again we may say the amount as written was the nearest approximation to that obtained by the calculation with his erroneous length of one side of the figure.

REFLEXIONS ON MODERN AND ANCIENT ORIENTAL WATER WORKS

JØRGEN LAESSØE

University of Copenhagen, Denmark

In an article entitled "The Irrigation System at Ulḫu," published in a previous issue of this journal (JCS 5 [1951], 21–32), I discussed the possibility of interpreting a section of Sargon's "Eighth Campaign"[1] as a description of a system of irrigation by means of subterranean aqueducts (*qanāts*, using the Arabic name)[2]. In that connexion I had occasion to make reference to a bas-relief, B.M. 118 906, dating from the reign of Ashurnaṣirpal II (883–859 B.C.)[3], and showing a rope and pulley used for raising well-water by the inhabitants of a besieged town (l.c., 32, with Fig. 2 [reproduced from A. H. Layard's drawing[4]] and note 95). Through the courtesy of Mr. C. J. Gadd, Keeper of the Department of Egyptian and Assyrian Antiquities in the British Museum, a photo of the original monument has now been provided, and is published as fig. 1 with the generous permission of the Trustees of the British Museum.

Only a fragment remains of the sculpture as originally discovered, and drawn, by Layard in 1847. The remains of the inscription on top of the fragment duplicate the "Standard Inscription" of Ashurnaṣirpal[5], lines 19–22, i.e. the last four lines of the inscription; the right edge of our sculpture represents the end of the section of the bas-relief to which it belonged.

The town shown in the relief is in the process of being captured by the attacking Assyrians; the defenders hold only the towers from which archers are still engaging the enemy. Spoil is already being carried away by Assyrian soldiers and servants; two of them carry buckets by the ends of the ropes to which they were attached. Layard, in Nineveh and its Remains 2 (1849), 31, described the scene illustrated in the sculpture when it was still complete, with the following words: "The lower [register] was the siege of a castle; an eunuch was represented discharging his arrows against warriors, without helmets, who manned the towers and walls. The besiegers were leading away prisoners, and carrying off the spoil. One high-capped warrior was cutting a bucket from a rope passed through a pulley; and probably used by the besieged to supply themselves with water from a well, without the castle walls."

The photo now reveals certain minor discrepancies between Layard's drawing and the original. The helmet of the Assyrian on the right is a perfect cone, and not rounded over the skull as if to follow its contours. The number of jags on the wall between the towers has been changed in the drawing; and the embrasures in the towers are not quite faithfully reproduced. The hairdo of the archers is not as shown in the drawing; their hair is actually arranged in waves running across the head from side to side.

The Assyrian soldier on the extreme right is not, in the situation perpetuated in this sculpture, "cutting away the bucket by which the besieged drew their water"[6]; this explanation is untenable

1. Lines 202–204 and 221 f. of the text in F. Thureau-Dangin's edition, Huitième Campagne de Sargon (TCL 3 [Paris 1912]).

2. In addition to the illustrations JCS 5, Pls. III–IV, and those listed ibid., 22 note 10, we may mention a good aerial photo (by Dmitri Kessel) of a *qanāt* system in the Zagros region, which appeared in the American magazine "Life," June 18, 1951, 110–111. There, extensive vineyards are irrigated with the water gained from the subterranean aqueducts. (To the references listed JCS 5, 30 note 81, add the description by Tukulti-Ninurta I of the canal leading water to Kār-Tuk.-Nin., KAH 2, 60, 102 [D. D. Luckenbill, Ancient Records 1, §167]).

3. In the Nimrud Central Saloon of the British Museum, Exhibit No. 65, this bas-relief is displayed among sculptures illustrating "Campaigns of Tiglath-Pileser III", as if belonging to his reign; in the Guide to the Babylonian and Assyrian Antiquities, 3rd edition (1922), it is listed on p. 48, No. 9, as one of "a small group of wall sculptures by Tigl.-Pil. III."

4. A. H. Layard, Nineveh and its Remains 2 (1849), 32, shows the part of the drawing reproduced JCS 5, 32; the original drawing in extenso published by C. J. Gadd, Stones of Assyria, Pl. 4 (fac. p. 16). Layard's description of the relief (op. cit., 2 p. 31) will be quoted presently.

5. Already noted by Gadd, Stones 144. The Standard Inscription of Ashurnaṣirpal is published AKA 212–221.

6. Gadd, Stones 144, who upholds Layard's explanation.

because the rope and pulley are behind the city wall, the pendant ends of the rope being hidden behind the latter (thus also in Layard's drawing!), whereas the soldier is shown walking away in front of it. The well, therefore, was inside the city wall, not outside it. When previously inside the city the soldier had cut the bucket from the rope under the pulley; he is now carrying it away as spoil, while in his right hand he still holds the knife with which he performed the

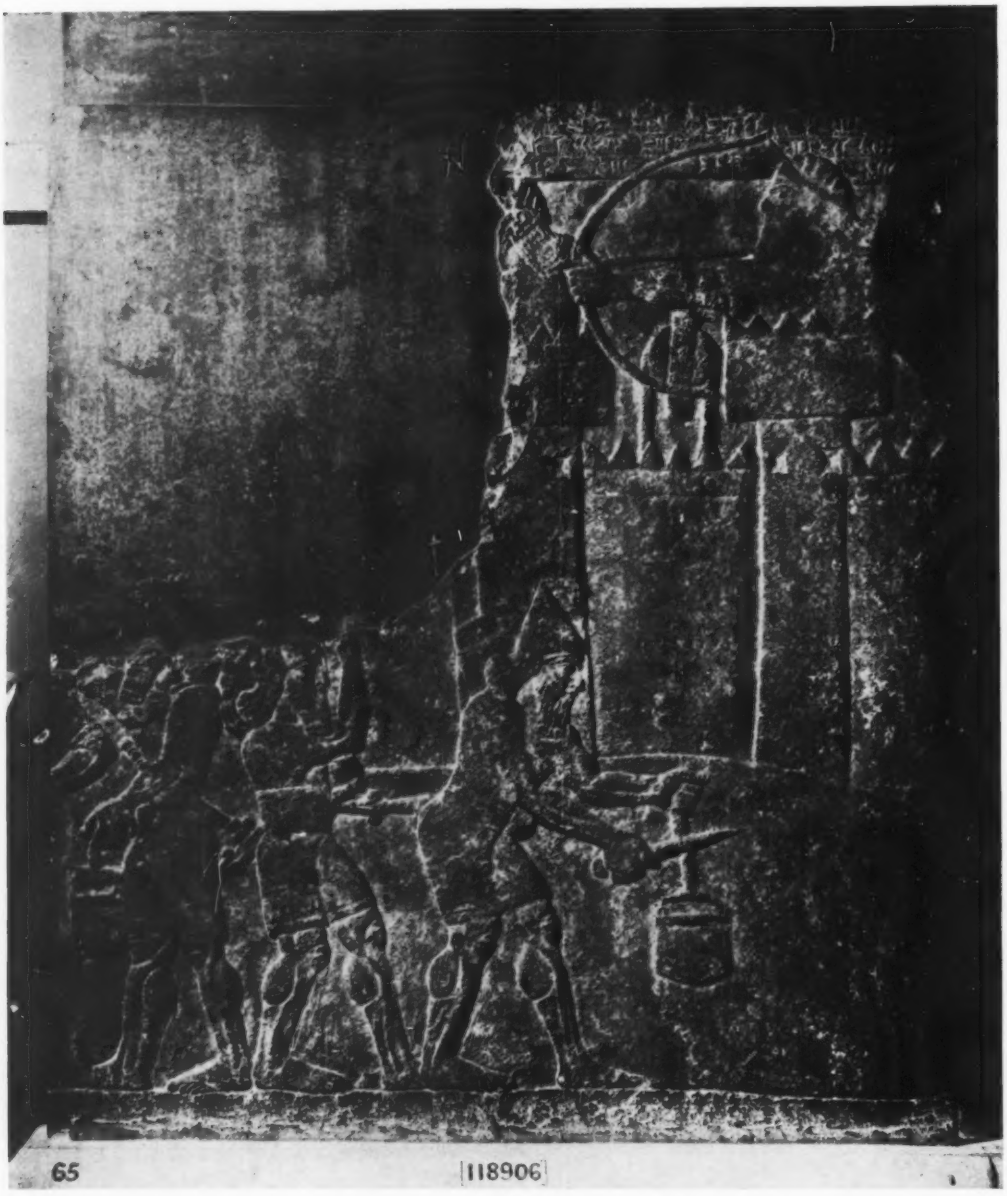

FIG. 1. Fragment of Assyrian bas-relief (B.M. 118906) from the reign of Ashurnaṣirpal II (883–859 B.C.); see p. 5. (By permission of the Trustees of the British Museum, London).

operation. We may be sure that the buckets shown in this relief were entered among the containers and vessels carefully listed as spoil in a great many places in the inscriptions of Ashurnaṣirpal[7].

Among the Akkadian terms for machines used in the process of raising water from wells or streams none has as yet been identified as a term for the rope and pulley.

In Iraq and Egypt water is nowadays raised for the purpose of irrigation mainly in four different ways, each of which requires a specific hydraulic engine. In speaking of irrigation I am in this connexion referring to cases where water must be lifted from a lower level to the higher level of the surrounding fields, and am paying no attention to the technique of irrigating by inundation followed by diking and canalisation[8]. The machines used for raising water in the modern Orient are, using Arabic names, the *šādūf*; the *čerd*; the *sāqia*; and the *nā'ūra*. They are mentioned here and will be quoted in the following by the name under which each one has become most commonly known in European literature; the Arabic terms, however, are not used consistently throughout the Middle East, but in many cases differ from province to province. In Iraq, the *šādūf* is known by the less specific term *dālia* "water-raiser"[9]; the *čerd* also has the name *bakra*; the *sāqia*[10] is called the *nā'ūra*, although this term in other dialects, and also in Irāqī, denotes the undershot water-wheel. Thus, in the two latter cases there is an overlapping in the terminology of the Irāqī dialect[11].

Only the *šādūf* is operated by hand, whereas power for the *čerd* and the *sāqia* is furnished by domesticated animals. The undershot water-wheel (*nā'ūra*) uses water power; its rotation is caused by and depends on the current of the stream, which imposes a restriction on its use; for a comparatively rapid flow of water is required to make it work successfully.

Typologically, the *šādūf* (fig. 2) is closely related to, and perhaps the ancestor of the European well-sweep. The Iraq type, which seems to differ in no way from the Egyptian one, is described as follows by V. H. W. Dowson in The Cultivation of the Date Palm on the Shat Al'Arab (1921 [see note 9]), 20 ff.: "Water is lifted in a leathern bucket (camel hide is the best), though sometimes a kerosene tin is used. This bucket is supported by a rope (or a pole) tied at the upper end to a bar, which, in its turn, is

7. E. g., AKA 231, 19; 238, 39; 241, 52; 273, 56; etc.

8. In ancient Babylonia the difference between the two kinds of irrigation was indicated by the terms *bīt dalū* (field irrigated by drawing water) and *bīt mē* (field irrigated by a canal). For *bīt dalū* in the Neo-Babylonian period see BE 9, 7, 10; TCL 13, 180, 25 and 203, 10; and cf. for Old Babylonian (where the corresponding term is *eqel dilūtim*) the series *ana ittišu* 4 II 22 ff. (MSL 1, 56; commentary ibid. 185 ff.). For *bīt mē* (Neo-Bab.) see BE 9, 7, 9 ff. and J. Augapfel, Babylonische Rechtsurkunden aus der Regierungszeit Artaxerxes I. and Darius II., pp. 81 f.

9. The name *šādūf* has been most commonly adopted in European descriptions of the machine; but *dālia* is the only term quoted for Iraq by V. H. W. Dowson, Cultivation of the Date Palm on the Shat Al'Arab (Dates and Date Cultivation of the 'Iraq, Part I. Agricultural Directorate, Ministry of Interior, Mesopotamia. Memoir III [1921]), 20; see also Dowson's Vocabulary of Date Terms, op. cit. 70 ff., s. v.; and in Egypt the term *šādūf* is restricted to the dialects between Golōṣana and Buṣrāṭ, whereas the Ḫarga dialect uses the term *dilw*. In Upper Egypt between Baḥarīf and Nazlat 'Abdilla the word *'ūd* ("wood," as a technical term) is most commonly applied (H. A. Winkler, Ägyptische Volkskunde [1936] 171 f.; cf. Déscription de l'Egypte 18/2 [Paris 1829], 543, 4°). According to R. Dozy, Supplément aux Dictionnaires Arabes 1 (1881), 458 b, *dalw* is also used as a name for the *šādūf*. The terms *dālia*, *dilw*, and *dalw* are all related to the verbal root *dlų*; in Akkadian occurring as *dalū* "to draw water"; in Arabic as *dalā* (see, e. g., G. W. Freytag, Lexicon Arabico-Latinum 2 [1833], 52: "1) demisit in puteum urnam . . .; 2) eduxit urnam hauriens aquam"; and A. de Biberstein Kazimirski, Dictionnaire Arabe-Français 1 [1860], 727: "Faire descendre (à l'aide d'une corde) le seau dans le puits. 2) Tirer, retirer le seau du puits (à l'aide d'une corde)". Zimmern, Akkadische Fremdwörter (2nd edition; 1917) 34, considers Aram. *daulā* "bucket" a possible loanword from an Akkadian **dūlu*, plur. *dūlāti*; "dagegen werden akk. *dalū*, hebr. *dəlî*, arab. *dalw* Schöpfeimer wohl urverwandt sein."

10. According to G. W. Freytag and A. de Biberstein Kazimirski (see preceding note) *dālia* is also a synonym of *sāqia*, or it denotes the undershot water-wheel (Freytag 2, 53: "rota aquaria, quae convertitur iumentorum ope . . . aut ipsa aqua;" Kazimirski 1, 728: "roue, machine à irrigation (syn. *nā'ūra*)."

11. For the term *nā'ūra* denoting the *sāqia* in Iraq see, e.g., B. Meissner in BA 5, 104 note 10. For *nā'ūra* as referring to the undershot water-wheel see Max Freiherr von Oppenheim, Vom Mittelmeer zum Persischen Golf 1 (1899), 333, and R. Koldewey, Das wiedererstehende Babylon (4th edition [1925]), 20. As a loanword *nā'ūra* has found its way into Sicilian, Spanish, French and English in the form *noria* (Karl Lokotsch, Etymologisches Wörterbuch der europäischen Wörter orientalischen Ursprungs [1927], no. 1561, and Webster's Dictionary, s. v.)

supported by a horizontal pole resting on two uprights, and is weighted at its free end usually with a lump of clay. The rope (or pole) tied to the bucket is pulled downwards by a man standing at the edge of the water until the bucket is pressed beneath the surface of the water and fills. It is now lifted up, the weight at the end of the swinging pole assisting its upward progress, until level with the irrigation channel, when it is emptied, and the whole process is repeated. A *dālia* seldom is employed to lift water more than about six feet." Of the illustrations accompanying Dowson's description, Pl. 18 shows a workman lifting the leather bucket to the top of the well; Pl. 19 represents a "double" *dālia* — two levers being operated side by side, carried by the same horizontal cross beam, by two men. This is also the case in an Oriental Institute photo published by J. A. Wilson, The Burden of Egypt (1951), Fig. 3b.

FIG. 2. Modern Egyptian *šādūf* photographed by Captain M. H. Davidsen at Kemān near Qifṭ (1913). Published with Capt. Davidsen's kind permission. (Copyright by the National Museum, Copenhagen).

Descriptions of the modern Egyptian *šādūf* will be found in Déscription de l'Egypte 16 (Paris 1825), 15 ff., and ibid. 18/2 (1829), 539 ff. ("Note sur le produit des machines à arroser, et particulièrement du châdouf en usage dans la Haute Egypte"); E. W. Lane, Manners and Customs of the Modern Egyptians (1890 [reprinted from the 3rd edition, London 1842]), 300 f.; H. A. Winkler, Ägyptische Volkskunde (1936), 171 f., with photo Pl. 51, 1; and a very detailed account in a Nubian dialect, with translation, drawings, and notes by Heinrich Schäfer in his Nubische Texte im Dialekte der Kunûzi (Abhdl. der kgl. preuss. Akad. d. Wiss., Philos.-hist. Kl., 1917 Nr. 5), 97–106 (a reference which I owe to Captain M. H. Davidsen)[12].

All modern specimens of the *šādūf* seem to have two vertical pillars supporting the horizontal cross bar on which one, or often two, levers rest. In this the modern type differs from most ancient reproductions of the *šādūf*, as will be seen later. It may be noted that in the *šādūf* reproduced by Dowson, op. cit., Pl. 19, two palm trees, the upper parts of which have been cut off, are used as vertical supporting beams; standing on their roots as they still are, they make a firm foundation for cross beam and levers.

In the *čerd* and the *sāqia* two different mechanical principles are involved. A rope and pulley is the basic element of the former, whereas the latter utilizes the principle of power transmission and gearing by means of cogged wheels.

The *čerd* is common in Iraq ("particularly along the Tigris, where the banks are high and steep" [King, A History of Babylon 172]) and throughout the Middle East — a drawing of a *čerd* from Mysore may be found in Winkler, op. cit., Pl. 107 — and is also known and used in Syria, the Arabian peninsula, and in North Africa west of Egypt, but seems absent from Egypt, where no mention of it by Lane, Winkler, or other authorities can be found.[12a] The Mesopotamian *čerd* has often been described by Europeans (disguised in renderings like charad [English] or Dschird [German])[13]; in the following I quote Dowson, op. cit., 23 f.: "The bucket is bigger [than that of the *dālia*] and invariably of leather, and is hauled up over a pulley, and, in order to gain purchase, the animal (cow, bull, bullock, pony, mule, donkey, or, in the Yemen and Morocco, camel) is provided with a steeply inclined ramp[14] down which it walks. The bottom of the bucket is provided with a tail, through which the water is discharged. While the bucket is being hauled up, the tip of the tail is kept high by a rope attached to the main haulage rope. On the Euphrates the whole apparatus is known as a *bakra*, and two *bakra* always are worked side by side. The double *bakra* is called a *charad*. On the Tigris the *bakra* generally are placed singly, and are called *charad*. A large camel skin bucket when new costs about fifty rupees. Plate 20 shows a *charad* at Amara, the bucket of which has just discharged its contents into the small, high-level, irrigation channel. Plate 21 shows a double *charad* at Zubair, where the water is forty feet below ground level. The pulley wheel is made of a large number of small pieces of mulberry wood, prized for its hardness. The supporting poles are of softer and cheaper silver poplar imported from Mosul. The cost of the leather, rope, and woodwork of such a *charad* as that illustrated in this plate would be about two hundred rupees; the cost of the four, big, white donkeys (working in two shifts) would be about a thousand rupees; and the cost of digging the big, forty foot deep well and of lining it with brush-wood and mats so

12. In India, where the *šādūf* is also in common use, it is known by the name *tulā* (Ananda Coomaraswamy, in JAOS 51 [1931], 283). A Semitic loanword?

12a. Captain M. H. Davidsen, whom I have consulted concerning the *čerd*, has kindly confirmed the truth of this remark. Captain Davidsen has never seen the *čerd* employed in Egypt nor found it described in literature dealing with the irrigation methods of the modern Egyptians. In J. Østrup's Det nye Aegypten (1929) the *šādūf* is described as if resembling a *čerd*; but, as Captain Davidsen informs me, this is an error which Østrup committed, and with which he was later on much annoyed.

13. Layard, Nineveh and its Remains 1, 354 f.; R. Koldewey, Das wiedererstehende Babylon, 19 f. (with photo); L. W. King and H. R. Hall, Egypt and Western Asia 294; L. W. King, A History of Babylon 172 f. Best photo published in The National Geographic Magazine 29 (1916), 133. A description of the construction of a *čerd*, in Irāqī Arabic dialect (transcription, with German translation, by B. Meissner), will be found in BA 5 (1903), 104 f.; cf. MVAG 18/2 (1913), 63. The Sanskrit name of the *čerd* is *karakaṭaka* (Coomaraswamy, l. c. 283).

14. The name of the ramp is *mē(i)dān* (Meissner, BA 5, 104 note 9).

that the sandy sides do not fall in would be about two hundred rupees." For the sake of terminology the following definitions may be added from Dowson's Vocabulary (op. cit., 70 ff., s. vv.): "*bakra*, a water hoist, consisting essentially of a leathern bucket, which is pulled up over a pulley by animal power", and "*charad*, on the Tigris, called a *bakra*, but on the Euphrates it consists of a pair of *bakra* side by side" (see also E. Bräunlich, The Well in Ancient Arabia [Lpz. 1925], 32 and 35 f.).

The *sāqia* is used extensively in Egypt, but not yet very widely in the Iraq[15], whither it has found its way — apparently rather recently, and probably from Egypt[16] — and acquired no name of its own, but became known under the name of the *nā'ūra*. The Egyptian *sāqia* has been described by Lane, op. cit. 301; by Winkler, op. cit. 172 ff. (photo: Pl. 52); and studied in great detail by Enno Littmann in an article, Die Sâqiya (ZÄS 76 [1940], 45–54, including a description of a *sāqia* at Qift, communicated by Captain M. H. Davidsen [pp. 49–51]); cf. also H. Schäfer, Nubische Texte im Dialekte der Kunûzi (1917), 107–114. Its effectiveness was investigated by M. Faye, a French official, in a statistical survey entitled Expériences faites sur le produit de quelques-unes des machines employées à l'arrosage des jardins ou au remplissage des citernes à Alexandrie, found at the end of Déscription de l'Egypte 18/2 (Paris 1829), facing p. 544. Essentially, the *sāqia* is a wheel along the outer rim of which vessels are bound sidewise. The wheel moves on a horizontal axis, and is geared by means of wooden cogs to another wheel rotating on a vertical axis and provided with a pole, which an animal turns as it — often blindfolded — moves around in a circle[17].

Whereas the *sāqia* is worked by animal power, and will raise water from a well or from a canal with stagnant water, the undershot water-wheel (*nā'ūra*) is moved by direct action of the water upon wooden paddles projecting from the rim of the wheel; it can be employed only in streams where the flow is sufficiently rapid to turn it, and is of no interest where water must be drawn from wells. In the Iraq, such water-wheels seem to be in use mainly at the upper and middle course of the Euphrates. Dowson says with regard to this subject (op. cit., 24): "At Hit gardens are watered by means of big water-wheels, supported on stone-dams set at right angles to the direction of flow of the river, and with many gourd-shaped, earthenware gugglets tied to their circumferences. The force of the rapidly flowing water in the river beats on the wings of the water-wheels, causing the latter to revolve, in doing which, water is lifted in the gugglets. When each gugglet begins to descend, its water is emptied into the channel which runs along the top of the wall or dam which supports the wheels. Nowhere else in the date country on the Tigris and Euphrates are there rapids or is there a firm bottom, both of which conditions are necessary for the comparatively easy construction and successful working of water-wheels."

Photos of water-wheels on the Euphrates are published by King and Hall, Egypt and Western Asia 293; A. T. Olmstead, History of Assyria (1923), Figs. 66, 71, and 76; and a description in King's A Hist. of Bab. 173 f. Photos of Syrian water-wheels will be found in Max Freiherr von Oppenheim's Vom Mittelmeer zum Persischen Golf 1 (1889), 333, and in The National Geographic Magazine 74 (1938), plate fac. p. 710 (wheel from Hama on the Orontes). Similar water-wheels are used throughout the Orient wherever the necessary conditions are present or can be created; cf., e.g., The National Geographic Magazine 72 (1937), 676 f., with a photo of a Chinese water-wheel (from Kwangsi) made of bamboo.

15. This statement may no longer be so valid as at the beginning of the century (Meissner, BA 5 [1903], 104 note 10: "Die Schöpfmaschinen [*nā'ūra*], wie sie in Syrien und Ägypten gebräuchlich sind, findet man im Iraq noch selten"), as irrigation is rapidly becoming mechanised in Iraq by the introduction of pump stations with modern machinery and steam engines or electric power; cf. already Dowson, op. cit. (1921), 25 ff., as against Max von Oppenheim, Vom Mittelmeer zum Pers. Golf 1 (1899), 334: "Pumpen sind in Syrien und Mesopotamien fast noch ganz unbekannt; nur in Baṙdad sah ich später ein paar Dampfpumpen im Gebrauch".

16. The *sāqia* is, however, well known also in India, where according to Coomaraswamy it has a long history (The Persian Wheel, JAOS 51, 283 f.). Its Sanskrit name is *araghaṭṭa(-ka)*.

17. A slightly different type of the *sāqia*, the so-called *tābūt*, is described by Lane (op. cit. 301) and Winkler (op. cit. 173 f. [photos: Pls. 53 f.]); sometimes, however, the *tābūt* is also called *sāqia* (for instance in Sanhūr [Winkler, l. c.]).

The questions may now be asked: Which of the hydraulic machines described above do we find in ancient sources; which may we yet expect to discover; and which are we not likely to find attested?

As will be shown in detail presently, the *šādūf* is well attested in ancient Mesopotamia and Egypt where we find it represented in glyptic art, bas-relief, and wall-painting, and undoubtedly also referred to in contemporary Akkadian texts.

With regard to the *čerd* we have seen that the pulley was known already in the first half of the ninth pre-Christian century. We might therefore plausibly expect to find references to the presence of the *čerd* at least from that time on, as the pulley is its basic element. The discovery of such a reference has been claimed by E. Ebeling; but as I shall attempt to show, the evidence on which the identification is based is not satisfactory.

I consider it unlikely that any reference to the *sāqia* will appear in ancient Mesopotamian sources. The mechanical principle on which the function of this machine rests — gearing by cogged wheels — appears to be a comparatively late discovery. It is possible that cogged wheels are described already by Aristotle; but it seems that Hero of Alexandria was the first to combine them in a system like that applied in the *sāqia*[18], which is therefore in all probability an invention dating from the Hellenistic period, or possibly a later Arabic invention[19]. It must be admitted, however, that B. Landsberger (followed by A. Salonen, in Studia Orientalia 11/3 [1945], 18) finds a reference to a hoist similar to the *sāqia* in the fifth tablet of the Babylonian lexical series ḪAR.*ra* = *ḫubullu* (cf. B. Meissner, Assyriologische Forschungen 1 [Altorientalische Texte und Untersuchungen 1/1; 1916], 22, col. i 80–85, and p. 32). But in view of the extreme brevity (no more than six lines) with which this apparatus is treated, it seems doubtful that a machine as complex as the *sāqia* can be intended, when it is remembered that an implement so relatively simple as the plough occupies sixty-two lines of the same tablet. [In his most recent publication Salonen has abandoned his previous view: Die Landfahrzeuge des alten Mesopotamien (Suomalaisen tiedeakatemian toimituksia, Sarja B, 72/3; 1951), 25 and 36 (with 178). Salonen has here uncovered proof that the term *maǧāltu* represents not a *sāqia*, but some type of chariot].

That the *sāqia* is derived from the undershot water-wheel, is entirely possible. In principle they are alike: in both cases water is lifted in buckets by a wheel. The difference lies in the nature of the power source; in this respect the *sāqia* represents an improvement over the *nā'ūra* in being independent of the presence of certain natural conditions. On the other hand, where these are present, the *nā'ūra* is extremely cheap to run and can be left working day and night without supervision.

The terminus post quem with regard to the appearance of the undershot water-wheel is difficult to establish. References to water-wheels mentioned by Greek and Roman authors are collected by Gerard Brett, in a short article entitled Byzantine Water-Mill, published in Antiquity 13 (1939), 354–356. According to Brett the earliest passage in classical literature mentioning a water-wheel is found in Strabo's Geography, 12, 3, 30: *ἐν δὲ τοῖς Καβείροις τὰ βασίλεια Μιθριδάτου κατεσκεύαστο καὶ ὁ ὑδραλέτης καὶ τὰ ζωγρεῖα καὶ αἱ πλησίον θῆραι καὶ τὰ μέταλλα.* Mithridates, King of Pontos, was defeated by Pompey in the year 65 B.C. In spite of the late date of this first appearance in classical literature, and the general scarcity of references to water-wheels in Greek and Roman sources (Brett, l.c., 355), it seems that in Babylonia a water-wheel was known in the period of the "Chaldaean" kings, Nabopolassar and his successors (so-called Neo-Babylonian period, 6th century B.C.), possibly already from the time of the First Babylonian Dynasty (approximately 18th–17th centuries B.C.). The pertinent material, as known to me, will be presented below.

The following paragraphs, then, will deal with the evidence for the *šādūf* and the water-wheel, and with the assumed evidence for the *čerd*.

It has been suggested that the *šādūf* was imported to Assyria from Egypt by Sennacherib (L. W. King, in CT 26, p. 26 note 1), or that the

18. Albert Neuburger, Die Technik des Altertums (1919), 219 f.

19. Nŏt available in Danish libraries was Hans Schmeller, Beiträge zur Geschichte der Technik in der Antike und bei den Arabern [Wasserhebemaschinen; Verlegung von Leitungen und über das Einlassen des Wassers in diese; etc.] (Abhandlungen zur Geschichte der Naturwissenschaften und der Medizin 6 [1922]).

same king introduced it in Assyria after Babylonian models (B. Meissner, BuA. 1, 193).

The evidence available at present indicates that the *šādūf* was known in Babylonia at a considerably earlier time than in Egypt. A cylinder seal from the Sargonic period (approximately 23rd century B.C.)[20] shows a *šādūf*, differing from the modern type only in that the upright support is formed by a single pole to the top of which the lever is attached (by means of ropes, or resting in a notch?), but evidently similar to some modern specimens (e.g. Dowson, op. cit., Pl. 19, referred to above) in the peculiarity that a date palm is used for the vertical support, which accounts for the laps on its sides (fig. 3).

FIG. 3. Representation of a *šādūf* on a Mesopotamian cylinder seal from the Sargonic period (from: W. H. Ward, The Seal Cylinders of Western Asia [1910], Fig. 397).

The earliest Egyptian representations of the *šādūf* date from the Amarna period (18th Dynasty), and are found in the tomb of the high priest Mery-Rē' at el-Amarna. Norman de Garis Davies gives the following description of the relief: "The picture of the walled garden . . . is a charming example of the love of the Egyptian artist for detail and his skill in suggesting the truth with which he was forced to compromise. A great part of the garden space is taken up by an enormous tank with steeply-sloping sides, down which steps lead, so that it may still be utilized when the infiltrating water lowers with the sinking of the Nile. When there is high-water in the river a *shadûf* on the bank (just visible under a date palm at the top of the picture) suffices, but as the pond dries with the sinking of the river, the gardener is forced, exactly like the *fellah* of present-day Egypt, to dig a well in the bottom and set up a second *shadûf* below the first, raising the water by two stages instead of one"[21].

Three later Egyptian representations (19. Dynasty) are from the Theban tombs Nos. 49, 138, and 217. Of these the painting in the tomb of Ipu (No. 217) has become especially famous, and has been reproduced a number of times[22]. The *šādūf*s shown in the tomb of Nefer-ḥotep (No. 49) were first rendered by J. Gardner Wilkinson[23], then published by Norman de Garis Davies[24]. The representation of *šādūf*s in the tomb of Nezem-ger (No. 138), from the reign of Ramses II, has only been published by Davies[25], in connexion with his excursus "The Shādūf in Egypt" (Tomb of Nefer-ḥotep, 70–73) and is reproduced here (fig. 4).

20. A drawing of the impression is published in W. H. Ward, The Seal Cylinders of Western Asia (1910), Fig. 397 (p. 147), a photo by L. Delaporte, Catalogue des Cylindres 2 (Acquisitions [Paris 1923]), No. A 156 (Pl. 72, 12), and by M. Rutten, Encyclopédie Photographique de l'Art, Tome II (1936), p. 75, No. 48. Cf. also H. Frankfort, Cylinder Seals (1939), p. 138. A literary parallel to this Sargonic representation of the *šādūf* is probably to be found in the so-called "Birth Legend", the narrative of how Sargon of Agade was found in the river by Aqqi, the water-drawer, when the latter plunged his bucket into the water (*i-na ṭi-ib d[a]-li-[šu]*; Landsberger apud Güterbock, ZA 42, 63 note 2). Although handed down in a late copy (for references see ZA 42, 62 note 1), the story must have originated in a time which was not far removed from Sargon's own life-time (cf. Th. Jacobsen, The Sumerian King List [AS 11; 1939], 145 f.). The name of Aqqi (i. e. *aqqī* "I watered"; Güterbock, l. c. 63 note 1) would seem to furnish an example of the verb *naqū* as a term for irrigating, wanted by Landsberger, Die Serie *ana ittišu*, p. 188.

21. Norman de Garis Davies, The Rock Tombs of El Amarna, Part I (Archaeological Survey of Egypt 13 [1903]), Pl. XXXII. Davies' description quoted from pp. 41 f.

22. Mémoires publiés par les membres de la Mission Archéologique Française du Caire, V (fasc. 3/4 [Paris 1894]), Pl. I fac. p. 612 (Paroi B, Registre cinquième); cf. pp. 607 f. Ludwig Curtius, Die antike Kunst 1 (1923), Pl. VI (fac. p. 184). Norman de Garis Davies, Two Ramesside Tombs at Thebes (Publications of the Metropolitan Museum of Art Egyptian Expedition, V [New York 1927]), Pls. XXVIII–XXIX and pp. 52 f. Luise Klebs, Die Reliefs und Malereien des neuen Reiches (1934), Abb. 25 (pp. 34 f.).

23. The Manners and Customs of the Ancient Egyptians (Revised and Corrected by Samuel Birch) 1 (1878), 281 (Figs. 93 and 94).

24. The Tomb of Nefer-ḥotep at Thebes, Vol. I (Publications of the Metropolitan Museum of Art Egyptian Expedition, IX [1933]), Pls. XLVI–XLVII and p. 36.

25. Tomb of Nefer-ḥotep, 71, Fig. 9.

As far as I have been able to establish, these few references form a complete list of illustrations of the *šādūf* in ancient Egypt. Hermann Kees has suggested that the machine might have been in use already under the Old Kingdom[26], whereas H. E. Winlock attributes its introduction to the Hyksos invasion[27]. So far, there is no proof that it occurs earlier than the Amarna period, as all alleged textual evidence for its presence seems most uncertain[28].

The ancient Egyptian models are all similar to the Sargonic type referred to above, consisting of one vertical beam only, to which the lever is attached. In all the ancient Egyptian occurrences the *šādūf* is furthermore a contrivance employed in horticulture rather than in agriculture. For agricultural purposes the ancient Egyptian fellahin depended on inundation by the Nile. The gardens, however, were usually situated on higher points which the flood would not reach; here the *šādūf* became of importance. In modern Egypt the *šādūf* is very definitely an agricultural implement (cf. fig. 2).

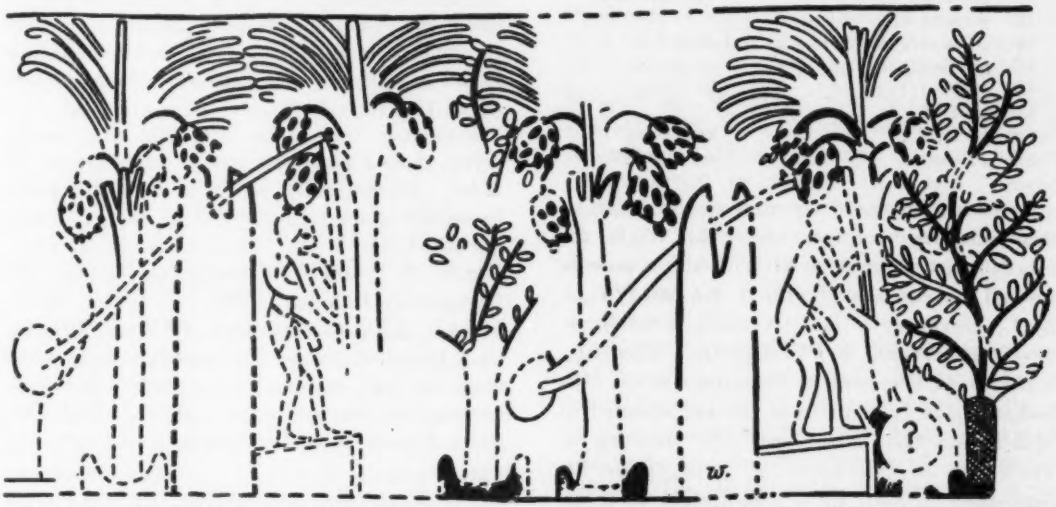

FIG. 4. Egyptian *šādūf*s from the 19th Dynasty in the tomb of Nezem-ger at Thebes (from: N. de Garis Davies, The Tomb of Nefer-ḥotep at Thebes, I p. 71, Fig. 9). See page 12.

In ancient Mesopotamia in the Old Babylonian period we find a total lack of illustrations of the *šādūf*; but there seems to be literary evidence for its existence. It appears to have been known by the name *makūtu* "pole"[29], which is entered in the sixth tablet of the lexical series ḪAR.*ra* =

26. Ägypten (Handbuch der Altertumswissenschaft. Kulturgeschichte des alten Orients, erster Abschnitt [1933]), 40.

27. The Rise and Fall of the Middle Kingdom in Thebes (New York 1947), 164. In favour of a hypothesis that the introduction of the *šādūf* into Egypt was due to desert nomads — and nomads presumably constituted at least part of the Hyksos invader — one may recall the custom mentioned by V. Christian, OLZ 24 (1921), 77 (with reference to S. Langenegger, Die Baukunst des Irâq, 191 ff.): ". . . die noch heute in Mesopot. herrschende Sitte . . . . ., wonach Reisende in der Karawane ihre eigene Hebevorrichtung mitführen, die sie im Bedarfsfalle auf den Brunnen-Oberbau aufsetzen und nach Gebrauch wieder mitnehmen". See also E. Bräunlich, The Well in Ancient Arabia, 94 ff.

28. For a discussion of Deuteronomy 11, 10 (irrigation in Egypt "by foot") see H. Schäfer, Tretmaschinen zur Bewässerung im alten Ägypten (ZÄS 54 [1918], 140 f.); cf. W. Spiegelberg, Zwei Ausdrücke der Bewässerung, ZÄS 53 (1917), 113 (see also ZÄS 56 [1920], 59). A Coptic text which perhaps alludes to the *šādūf* is discussed by Davies, Tomb of Nefer-ḥotep, 71.

29. S^{b}, 2nd tablet, 333: *di-im* = DÌM = *ma-ku-tú*. Cf. Delitzsch, HWB 407; see also OLZ 8 (1905), 382; ZA 9 (1894), 132; ZA 17 (1903), 245 f.; and A. Salonen, Wasserfahrzeuge (Studia Orientalia 8/4 [1939]), 8. For *makūt agurri* in the Neo-Babylonian royal inscriptions, see VAB 4 (1912), 72, 38 and 106, 12. The identifications proposed by Christian, in the article Ueber einige babylonische Ackerbau- und Bewässerungs-Geräte (OLZ 24 [1921], 74–77), viz. *nāru* "*šāduf*" and *epinnu* "*čerd*", are no longer valid after the correct interpretation of *epinnu* as plough was made by M. Witzel, Keilinschriftliche Studien, Heft 1, 1 ff.

ḫubullu, lines 155 ff. (in H. Zimmern's edition[30], p. 262). The pertinent section of the tablet is attested by the two texts K. 4403 (CT 12, 44 [previously published 5 R 26, No. 1]) and Si. 20 + 27 + 31/52 (MAOG 4, 268–271), as follows (quoted after Zimmern):

ḪAR.*ra* 6,		
152	*giš.nam(?).ša.al.kum*	*šum-man-n*[*u*]
153	*giš.nam.tar*	"
154	*giš.nam.tar.ra*	*ša-al-kum*
155	*giš.dìm(?).*(x)[31]*.gú*	*ma-ku-tum*
156	*giš.dìm(?).*(x)[31]*.lá*	*di-lu-tum*
157	*giš.*I.LU	"
158	*giš.*I LU	*as-kup-pu*
159	*giš.dìm*	*ma-ku-tum*[32]

šummannu seems to be part of the *šādūf*, or something used in connexion with it; in the fourth tablet of the series SIG$_7$.ALAM = *nabnītu* we find this equation (K. 197 + Sm. 294 [CT 12, 34 f.; previously 2 R 7]): [x]GÛ *zi.ri.kum* = "(= *šum-man-nu*) *šá* PÛ (line 32). The Sum. *zi.ri.kum* (a loanword in Sumerian) is the Akkadian *ziriqu* (variant form **zaraqu* attested in Middle Assyrian as *zaruqu*[33]), the meaning of which can be established as "pipe, gutter"[34]; *šummannu ša būri*, then, would seem to mean "pipe of a well." *šummannu*, as something pertaining to the *šādūf*, may well turn out to be a water pipe or conduit like those depicted in the tomb of Nefer-ḥotep, through which the water drawn in the bucket reaches its destination.[35]

I would propose to interpret the logogram *giš.dìm(?).*(x)*.gú* (ḪAR.*ra* 6, 155) as "supporting pole (?)" (i.e., the vertical support), and *giš.dìm(?).*(x)*.lá* (ibid., 156) as "lifting pole (?)" (i.e., the lever), on the basis of the presence of the elements *gú* and *lá* respectively. By a synecdoche the term *makūtu*, if denoting the vertical pole — easily the essential part of the machine — could be applied to the entire *šādūf*, a theory which would explain the entry *giš.dìm* = *ma-ku-tum* (ibid., 159).

Economic texts from the Old Babylonian period show a surprising lack of references to the *šādūf*. Exceptionally, a field at Dilbat irrigated by *šādūfs* seems mentioned in an economic text published by J. E. Gautier, Archives d'une famille de Dilbat au temps de la Première Dynastie de Babylon (1908), No. V (pp. 29 f.): 3 GÁN A.ŠÀ *i-na ma-ka-ti* PAP+E ^{d}IB (cf. OLZ 13 [1910], 158). The procedure followed in irrigating by *šādūf* is undoubtedly described, however, in the series *ana ittišu* 4 II 33–35, which I quote after Landsberger's edition[36]:

4 II 33	*á.lal.e ab.dù.*[*dù*]*.e*	*du-la-a-ti ú-rat-ta*
34	*giš.zi.ri.kum ù.b*[*i.in(?).ga*]*r*	GIŠ*zi-ri-qa i-lal-ma*
35	*a ib.ta.an.ba*[*l.e*]	A.MEŠ *i-da-al-lu*

and translate:

33 "he will attach the poles[37] securely,
34 fix the pipe[38], and
35 draw water."

30. Heinrich Zimmern, Die sechste Tafel des babylonischen Vokabulars ḪAR-*ra* = *ḫu-bul-lum* (MAOG 4 [1928–29], 252–273).

31. Uncertain whether a sign is missing (Zimmern, l. c. 262, note).

32. A detailed analysis of the structure of the water-hoist as explained in ḪAR.*ra* 6, 150 ff., has been promised by B. Landsberger, Die Serie *ana ittišu* 189. "[Diese Schöpfvorrichtung] scheint einen Brunnen vorauszusetzen" (l. c.). For the logogram *giš.*I.LU (lines 157 f.) cf. B. Landsberger and H.-G. Güterbock, Das Ideogramm für *simmiltu* ("Leiter, Treppe"), AfO 12 (1937–39), 55 f. For *dilūtu*, cf. H. Waschow, MAOG 10/1 (1936), 62 line 33 and (from the Akkadian Synonym List "D") ZA 43, 240 line 166: *ka-ak-kal-tum* = "(= GIŠ$_{erinu}$) *di-lu-tum* "cedar for drawing (water)". A well from which water was drawn (by a *šādūf*?) was called *būr madlē* (ZA 43 [1936], 13 line 8).

33. MAOG 7, 1/2 (1933), 55 note e.

34. RA 15 (1918), 77, rev. 7. See also *ana ittišu* 4 II 34. A closely related term, attested in Old Babylonian, seems to be *terdītu* (TCL 7, 39, 15; quoted below, p. 24, from *redū*, for which see Landsberger, ZDMG 69 (1915), 494 ff.

35. *šummannu* is also a leather object (leather fitting, or the like), in which sense it is a synonym of *kurussu*; see — besides Delitzsch, HWB 671 and 355 — Meissner, AOTU 1/1, 37 and Ungnad, ZA 31 (1917), 50.

36. B. Landsberger, Die Serie *ana ittišu* (MSL 1 [1937]), 57; cf. commentary pp. 185 ff. (Die Pacht *ana dilūti* Kol. II, 22–39).

37. The translation is Landsberger's ("die Stangen des Schöpfbrunnens"). Is the singular **dulītu*, a *fu'ail* form to the *dilūtu* of ḪAR.*ra* 6, 156? (The diminutive form *fu'ail* rare in Akkadian, but attested e. g. in *upīšu*, a deprecatory word denoting the machinations of witches, CT 16, 2, 58; 33, 182; 37, 9; other references in L. W. King, Bab. Magic and Sorcery [1896], 139 s. v.; and in *šurīpu*, see Landsberger, ZA 42, 158). The logogram *á.lá* suggests the translation "pole", or more specifically "lever". This is evidently a *šādūf* with several levers (but supposed to be operated by one man!). Unlikely is the meaning "bucket" assumed by Delitzsch (HWB 218, s. v. *dultu*(?)) and Zimmern (Akkad. Fremdw.^{2}, 34: **dūlu*).

38. See notes 33–34.

As in ancient Egypt, the *šādūf* was probably used in Babylonia mainly to draw water from wells, and to irrigate gardens, whereas the fields usually required quantities of water which could be supplied only by inundation, and apportioned to individual users only by diking and canalisation.

When in the seventh century B. C. Sennacherib makes reference to the *šādūf*, it is also as a machine employed in connexion with the wells. The passage in question occurs more than once in Sennacherib's inscriptions[39]; it is quoted here from the Octagonal Prism B.M. 103000 (CT 26, 1–37), vii 45–49:

45 *áš-šú* UD-*me-šam-ma* A.MEŠ *di-lu-ti*
46 *da-lum eb-li gu-ḫaṣ-ṣa-a-te* UD.KA.BAR
47 *u ḫar-ḫa-ri* UD.KA.BAR *ú-še-piš-ma*
48 *ki-mu-u ma-ka-a-te giš-maḫ-ḫi ù a-la-mit-ta*[40]
49 *ṣi-ir* PÚ.MEŠ *uš-ziz*

Line 46 has often been misread; and some translations of the passage are therefore misleading[41]. In spite of the difficult *da-lum* (*dalūm*; to be expected was *dalēm*, i.e. genitive of the infinitive after *aššum* denoting intention) I venture to translate:

45 "In order that you might draw(?) (well-) drawn water every day,
46 I had ropes, "cables" of bronze
47 and "chains"[42] of bronze made, and
48 instead of šādūfs (*makātē*) I let . . . beams and the date palm
49 stand over the wells."

This is evidently a description of an improved method of raising water from the wells in Assyria, and as mentioned earlier (p. 11 f.) it has been interpreted as referring to the introduction of the *šādūf* into this country (King, Meissner; also Olmstead, as will be seen subsequently). I could think of a number of objections to this theory. Since the *šādūf* was known in Babylonia in the Sargonic age, it is reasonable to assume that it was not unknown in Assyria before the reign of Sennacherib. Moreover, *kimū* (line 48) always implies actual replacement; it means "instead of," and cannot be rendered as "in the capacity of; like"[43]. Line 48, therefore, indicates that Sennacherib's new water-hoists replaced the *šādūfs*; hence it follows that these had been in use previously.

A fundamental difference between Babylonia and Assyria is caused by the climatic and geological dissimilarity of the two countries. Babylonia is an alluvial plain; its culture depends on the rivers and the maintenance of innumerable canals. The subsoil water in most cases is not far beneath the surface. Assyria is hilly and mountainous; the culture of the country depends on rainfall and springs; the subsoil water must be looked for at great depths.

During the reigns of the Sargonids (721–612 B.C.), and especially under Sennacherib, we witness a never ending effort to increase the water supply of the cities of Assyria. Whether the reason be an increase in population, brought about also by the deportation and resettling of entire nations which had been going on as a common practice since the days of Tiglath-Pileser III, or a subtler one, we see Sennacherib engaged in an untiring endeavour to provide water for the nation. Water had to be stored in tanks and cisterns; often it had to be tapped from sources in distant places, in which case aqueducts were necessary.

The passage of the Octagonal Prism which was quoted above, should be viewed in the light of

39. B. Meissner and P. Rost, Die Bauinschriften Sanheribs (1893), 14 [could not be consulted by the author]; Bull Inscription published by A. H. Layard, Inscriptions in the Cuneiform Character (1851), Pls. 38 f., lines 9–13 (see Luckenbill, Annals of Sennacherib, p. 118); Foundation Stela (VAT 8248 [KAH 2, 122]), lines 37–39 (Luckenbill, op. cit. 124).

40. There is an, undoubtedly insignificant, erasure after the sign TA (cf. King, CT 26, p. 26 n. 1); no such erasure after *a-la-mit-ta* in col. vii 10.

41. King, in CT 26 (1909), p. 26; Meissner, BuA. 1 (1920), 193; A. T. Olmstead, History of Assyria (1923), 331. D. D. Luckenbill, Annals of Sennacherib (OIP 2 [1924]), 110, and same author in Ancient Records of Assyria 2 (1927), §393.

42. To *eblu* (cf. Arabic *ḥabl* as a terminus technicus "Tau des Schöpfrades") in the Egyptian *sāqia*, Littmann, ZÄS 76, 51. For *guḫaṣṣu* (*guḫalṣu*, *kuḫazzu*) and *ḫarḫaru*, both meaning "rope", see Landsberger, ZA 43, 75 (to line 77) and W. von Soden, ZA 43, 259 f. For *guḫaṣṣu*, see also W. F. Leemans, Ishtar of Lagaba and her Dress (SLB I/1 [1952]), p. 1, line 11 (*gu-ḫa-aš-šum ša wu-ur-ri-qí-im* "cord of yellow metal-alloy"), and p. 10 f.

43. *kimū* (for **ina kimi*; cf. *qirbū* for *ina qirbi*, etc.) "instead of; in the place of", for example in King, Babylonian Boundary Stones (1912), p. 41, ii 33; kudurru of Melišipak, MDP 2 (1900), Pls. 21-23, iv 48 and v 13 and 32; 3 R 38, i 38; 5 R 1, 38; PBS 2/2, 138, 13.

this situation. On Assyrian soil the *šādūf* cannot work satisfactorily. As we have seen, the *dālia* of modern Iraq is seldom used to lift water more than about six feet (Dowson, quoted p. 7). The water-table rarely stands as high as that under the surface in Assyria; the wells must reach far greater depths to yield water[44], and the *šādūf* must often have been a poor help to the farmer. When Sennacherib says that water could now be drawn from the wells every day (line 45), he probably means that irrigation became independent of the level of the subsoil water-table. However low the water-level in the wells, it could now be reached by the water-hoists; a permanent water supply[45] had been secured.

In the newly introduced water-hoists of Sennacherib, with the great emphasis on ropes and chains (lines 46 f.), I suspect a winch; but the technical term for this apparatus, which seems to have been *imēru*[46], is not used. The interpretation depends largely on the terms *gišmaḫḫu* and *alamittu*.

gišmaḫḫu, as far as I know, occurs only here and in col. vii 9 of the same text and must be understood from the Sumerian elements which constitute the word; thus, it would seem to mean "high (elevated?) beam", but it is of course not unlikely that *gišmaḫḫu* is a technical term with a very specific meaning.

44. The Assyrian name for the subsoil water is *mū šaplūtu* or *mē naqbi* (cf. JCS 5, 25 note 30; for the term *asurrakku* see A. Poebel, ZA 37 [1927], 271); "the water table" is called *muḫḫi mē* (Ashurnaṣirpal). At Kalḫu Ashurnaṣirpal reached the water table at a depth of 120 *tikpu* (1 *t.* = the height of one course of bricks) (AKA 176, 12; 186, 16; 209, 16; 220, 17; 387, 136); at Nineveh Sennacherib could safely bury an inscribed cylinder at a depth of 160 *tikpu* (Luckenbill, Anc. Records, 2, §374) and did not strike water until he reached a depth of 45 GAR, approximately 21 m (40 + 5 GAR *ú-šap-pil-ma ú-ša-ak-šid* A.MEŠ *na-aq-bi*; CT 26, 1–37, viii 8 f.). For Babylonia one may compare the situation facing Koldewey during the excavation of Babylon, where the greater part of the ruins dating from the period of Hammurabi were hidden below the subsoil water table. (R. Koldewey, Das wiedererstehende Babylon [4. Aufl., 1925] 234; O. Reuther, Die Innenstadt von Babylon, 4).

45. "Permanent water-supply", a frequently recurring theme; for instance, *me-e ṣa-tim* (BIN 1, 76, 12); *ma-a-me da-ru-ú-ti* (Sennacherib; cf. Th. Jacobsen, Sennacherib's Aqueduct [OIP 24; 1935], 33 note 9); *mi-e . . . la na-pa-ar-ku-ti* (VAB 4, 212, ii 10).

46. See JCS 5, 32 note 94.

Contrary to the statement of C. J. Gadd, Iraq 13 (1951), 37[47], it can be shown that *alamittu* (or *elamittu*) is a rare name for the date palm. First, in the Akkadian Synonym List "D" edited by W. von Soden (ZA 43 [1936], 233–250), line 128 furnishes the equation *e-la-mit-tu* = "(= *gi-šim-ma-rum*) (l.c., p. 239)[48]. That the meaning is "date palm", can also be demonstrated from a passage in a series of Assyrian hymns published by R. Brünnow in ZA 4 (1889), 225 ff. Here, in the text K. 2361, rev. col. iv, we read (l.c., p. 254):

6 *aḫ-ra-taš pi-iš-nu-kiš làl-la-riš ú-da-aš*-x( )
7 *a-la-mit-tum ú-ḫe-en-šá da-da-riš ma-a*-[x]
8 *ar-ka ta-ad-me-eq-šá da-me-eq pi-ir-'u* NU x[ ]

6 "In the future . . . . . foolishly[49] like a mourner;
7 the green date[50] of the date palm . . . . . disgustingly[51];
8 afterwards its date(?)[52] is good, the sprout . . . not? . . ."

47. Gadd finds a resemblance between *alamittu* and *allu(m)zi* (a thorny plant), for which he refers to R. C. Thompson, A Dictionary of Assyrian Botany (1949), 185. F. M. Th. Böhl suggests a meaning "bush" (*alamittu* "ist nicht nur das hölzerne Rahmenwerk . . ., sondern wohl auch ein bestimmter Strauch", Symbolae . . . Koschaker [Studia et Documenta 2; 1939], 175 f.; cf. translation "Gesträuch" ibid. 165).

48. The duplicate B gives: *ḫu-la-me-tú* (l. c., 239 note 72). Apparently *alamittu* is also listed in the series ALAM = *lānu*, in a rather obscure context; the text K. 4243 (CT 18, 39 ff.) gives the following series of equations (Pl. 41, lines 40–44):

40	BU.BU.I	*na-a-x*[ ]
41	BU.BU.I	*a-la-mi-t*[*u*](?)
42	BU.BU.I	*ib-r*[*u*]
43	BU.BU.I	*ni-ib-r*[*u*]
44	BU.BU.I	*šu-uq-qu-'ú'*

49. *pisnuku*, a synonym of *enšu* "weak"; see Delitzsch, HWB 518, W. Muss-Arnolt, Assyr.-Engl.-Deutsches Handw. 2 (1905), 792 f., and cf. F. H. Weissbach, Babylonische Miscellen (WDVOG 4 [1903]), Pl. 8, 19; ZA 43, 56, line 142 (Landsberger: *pisnukiš* "wie ein Bettler"); and, for an etymology, W. F. Albright, RA 16 (1919), 188 no. 35.

50. *uḫinnu*: green dates picked while still unripe and ripened in storage; see Landsberger, Die Serie *ana ittišu*, 200 ff.; A. Ungnad, Neubab. Rechts- und Verwaltungsurk. 1 (1929–35) Glossar (1937), 10; R. C. Thompson, A Dictionary of Assyrian Botany, 310.

51. *dadariš*, cf. — besides Delitzsch, HWB 211 f. — S. Langdon, Babylonian Wisdom (1923), 46 line 23. For the plant *dadaru* see V. Scheil, ZA 10 (1895), 204.

52. *tadmiqu* (*tadmiqtu*) is otherwise known as denoting a sum of money lent without interest to a travelling

A third clue is a further passage from Sennacherib's Octagonal Prism, where *gišmaḫḫu* and *alamittu* are mentioned side by side, and the latter described with an epitheton ornans as *iṣ mešrē* (vii 9–10): *giš-maḫ-ḫi ù a-la-mit-ta* GIŠ *meš-re-e*. Now, *iṣ mešrē* "tree of wealth, tree of plenty" as a name for the date palm occurs in the Babylonian "Theodicy"[53], line 56, which reads (after Landsberger, ZA 43, 50): [*gi-š*]*im-ma-ru* GIŠ *maš-re-e* (Variant: *meš-re-e*) *a-ḫi aq-r*[*u*] "Date palm, tree of wealth, my precious brother!" Neither the term *alamittu* nor *iṣ mešrē* is entered in the third tablet of ḪAR.*ra* = *ḫubullu*, as might have been expected; but Landsberger, ZA 43, 75 has pointed out that that tablet does offer a logogram which fits the term *iṣ mešrē*. In my quotation I follow the line numbering of the revised edition which I have prepared (1951) for the Akkadian Dictionary Project at the Oriental Institute, Chicago, under Professor Landsberger's direction:

ḪAR.*ra* 3,[54]	
273 *giš.nig.tuk*	*gi-šim-ma-ru*
274 *giš.mu.nig.tuk*	"
.	.
.	.
.	.
281 *giš*.GIŠIMMAR	"

Closely related to the equations *gišimmaru* ~ *iṣ mešrē* ~ giš.níg.tuk is an entry in the synonym list K. 4375 (CT 18, 1 ff.), which among other sequences gives a series of "Schmucknamen" for the date palm; here, in col. i 60, we find:

GIŠ *ra-še-e*	" (= [*gi-šim*]-*ma-ru*)

The palm, then, was known both as "the tree of wealth" and as "the tree of 'having'."

Not inconsistent with the identification of *alamittu* reached from the texts quoted above, is the occurrence in the Cylinder of Nabonidus YBC 2182 (YBT 1 [1915], No. 45), i 41–43, dealing with the state of the sanctuary E-gibar at Ur:

41 *a-šar-šu na-di-ma e-mi kar-mi-iš*
42 GIŠ*a-la-mi-it-tim in-bi ṣi-ip-pa-a-tim a-ṣu-ú qir-bu-uš-šu*
43 *ak-ši-iṭ-ma iṣ-ṣi e-pi-ri ka-ar-mi-šu as-su-uḫ*

41 "Its place lay waste and was like a heap; (but)
42 the (trunks of the) date palms[55] (and) the orchard fruits[56] protruding[57] from its midst
43 I cut down, and the trees (growing in) the dust (? *epru*) of its heap I tore up."

The improved water-hoist of Sennacherib evidently consisted of two upright poles supporting a horizontal bar for which the trunk of a date palm was used. We might assume that this framework formed the foundation for the lever of a *šādūf* of the type used in the modern Orient (cf. fig. 2); we have seen that palm trunks are and were used for such purposes in Iraq (Dowson, op. cit., Pl. 19). But the ropes, etc. (*eblu*, *guḫaṣṣu*, *ḫarḫaru*), which are an essential part of the hoist, would rather suggest that the horizontal cross bar was used as a winch, the advantages of which have already been discussed.

In view of the considerations of the preceding paragraphs a well-known bas-relief of Sennacheribs[58] needs reinterpretation. By almost common

agent (Landsberger, OLZ 25, 409; cf. ZDMG 69, 523 note 2). Here, it appears to be a term applied to the fruit of the date palm.

53. B. Landsberger, Die babylonische Theodizee (ZA 43 [1936], 32–76).

54. Text after school tablets from Kish in the Ashmolean Museum, published by P. E. van der Meer, Iraq 6 (1939), pp. 144–179 (Nos. 50 and 60).

55. The palm trunks may have supported a roof over the shrine, most of which was roofed in (L. Woolley, Ur of the Chaldees [1938], 88); but a better explanation for the presence of these trunks and the "orchard fruits" is found in Woolley's theory that trees were planted on the zikkurat, whence they had fallen down into E-gibar (The Ziggurat and its Surroundings [Ur Excavations 5; 1939], 120). In C. J. Gadd's opinion the trees were planted in the *gibar* itself (Royal Inscriptions [Ur Excavations. Texts 1; 1928], No. 67, p. 15 note 7); in this overshadowed grove was then built the E-gibar. The excavation of the E-gibar of Nabonidus is described by Woolley in Antiquaries Journal 5 (1925), 377 ff. On the Sumerian name *gi*$_6$*.bar*, see A. Deimel, ŠL 427, 37. Borrowed into Akkadian as *gipāru*, the word is explained as a synonym of *rītu* "pasture" and *tamirtu* "meadow" (Synonym List "D", ZA 43, 238, lines 111 and 112). See also F. M. Th. Böhl, Symbolae . . . Koschaker, 176.

56. For *inbi ṣippātim* cf. Th. Jacobsen, Sennacherib's Aqueduct, 33 note 5.

57. Another occurrence of (*ṿ*)*aṣū* in the sense of "protruding, projecting" in the Abū Ḥabba Cylinder of Nabonidus, col. ii 65 (VAB 4, 226): ŠU.SI *la a-ṣe-e* ŠU.SI *la e-re-bi* "an inch of no protruding, an inch of no indenting", which means that the bricks of the wall in question were completely plumb.

58. B.M. 51-9-2, 6 (C. J. Gadd, Stones of Assyria 170, Slabs 51–52). Drawing by Layard, Monuments of Nineveh 2 (1853), 15; reproduced in A. Paterson, Palace of

consent the scene representing a series of *šādūfs* has been regarded as an illustration of the text of the Octagonal Prism, vii 45–49, quoted and discussed above. Thus, in a somewhat glamorous description of Olmstead's (History of Assyria 331 f.) we read: "Rarely in antiquity do we find common objects in the very act of being transplanted from one country to another, but here we learn the first introduction of the Egyptian well-sweep in place of the old draw-well. 'That daily water in abundance for irrigation might flow, levers of bronze and buckets of bronze I fashioned, and in the place of the draw-wells great beams and wooden frameworks over the well-shafts I erected'[59]. Sennacherib was amply justified in representing this prototype of the 'Old Oaken Bucket' and the New England well-sweep in his sculptures. A labourer stands on a pier in the river, separate from the stepped support of the weighted pole, and with the triangular buckets lifts the life-giving fluid to two higher levels. The introduction of such a labour-saving device was compensation for many a barbarity inflicted in war." That I disagree with this interpretation in a number of points is perhaps clear from the preceding discussion of the *šādūf* in the ancient Orient and from the translation of the Octagonal Prism text vii 45–49, p. 15. I shall point out only two inconsistencies. First, the water-hoists of Sennacherib were placed over wells (*ṣīr būrē ušzīz*, line 49); in the bas-relief the *šādūfs* are operated on a river bank. Second, the river bank is occupied by a steep hill, and no cultivated land is seen in the vicinity; it is therefore very difficult to see how the water raised to successive levels by the *šādūfs* could be of any use for the purpose of irrigating fields or gardens.

It is furthermore rather puzzling that the *šādūfs* and the men operating them should have been represented in a much smaller scale than the rest of the picture. Ludwig Curtius, in his book Die antike Kunst 1 (1923), 276 ff., thinks that this is a case of "inverted perspective," and gives the following description: "Oben streifenartig die Gebirgslandschaft mit botanisch getreu wiedergegebenen Bäumen wie in Abb. 237. Darunter die königliche Garde streifenartig. Das sind Rudimente der älteren Darstellungsweise. Aber nun ein völlig neues Bild. *Eine* grosse Szene einheitlich von hohem Augenpunkt aus gesehen. Tief unten der Fluss und — der Beginn wirklicher Perspektive —, die in kaum halber Grösse der übrigen Figuren gebildeten Wasserschöpfer auf der Sandbank zwischen Strom und Kanal. Niemals in ihrem ganzen Verlauf ist die ältere antike Kunst so nahe an die Lösung der *Perspektive* herangekommen wie hier. . . . . Unser Bild . . . gehört zu einer grossen nicht ganz erhaltenen Folge, in der der Transport eines roh behauenen Stierkolosses . . . aus den Steinbrüchen im Gebirge zu Wasser und zu Lande geschildert wird. Nun ist die riesige Steinlast auf ihrem Schlitten an den Landungsplatz, der auf einem anderen Bilde durch Abtragung des Geländes eben gewonnen wird, zu Wasser gebracht worden, ist ausgeladen und wird bergan geschleppt. Rechts steigen Arbeiterkolonnen bergan und schütten die zur Planierung des Terrains entfernten Erdmassen aus. Links sind vier Kolonnen im Begriff, den Koloss mit grossen Tauen, an denen sie angespannt sind, vorwärts zu bewegen. Rechts unten hilft eine andere Gruppe durch Anlegen eines Hebels. Auf dem Koloss selbst stehen die technischen Leiter des Unternehmens, deren einer mit Gesten, ein zweiter durch ein Sprachrohr kommandiert, der vierte die Bewegung der Last kontrolliert. Diese Figuren bezeichnen etwa die Augenhöhe, von der aus das Bild angelegt ist."

In Curtius' opinion, then, the focus of the space represented in the drawing rests with the four men who supervise the job from top of the bull colossus, from which the *šādūf* workers were to be seen at some distance. Against this explanation speaks the circumstance that the dock workers in the lower right corner are represented in full scale. It would also seem strange that the only approach to perspective in Assyrian art should happen to be a case of "inverted perspective."[60]

Sinacherib (1915), Pls. 32/33, and Meissner, BuA. 1, Tafel-Abb. 94. No photo of the original monument has been published.

59. For references to transliterations on which this (erroneous) translation is based, see note 41.

60. References to other (assumed) examples of the "inverted perspective" ("umgekehrte Perspektive") in Heinrich Schäfer, Von ägyptischer Kunst (3rd edition; 1930) 384, note 243 a. The validity of the theory is doubted by Schäfer, op. cit. 243: "Ich glaube auch, dass man sich täuscht, wenn man in einigen Darstellungen eine Art Perspektive zu erkennen glaubt, bei der die Dinge mit den Augen der Hauptperson gesehen sein, also um so kleiner werden sollen, je weiter sie von ihr, etwa der grossen Königsfigur, entfernt sind. Es ist gut, sich

One of the laws of perspective in European art is that objects of the same size must be rendered smaller the further they are away from the spectator. This type of perspective is absent from Babylonian and Assyrian art, although we know that the ancient Mesopotamians were not unaware of the phenomenon; a famous example is found in the legend of Etana who, when being carried towards the sky by an eagle, saw the ocean first as a river, then, when still higher, as a gardener's ditch. The ancient artist, then, aimed at something else; he was not tied down by the aspect of perspective, and did not imitate nature, but represented it. His art does not lack clarity; only sometimes our conventional approach impedes the understanding of a picture which is largely conceptual.

Being altogether inconsistent with the topography of the landscape depicted in Sennacherib's bas-relief, the *šādūfs* must, I think, be seen as intimately connected with the general situation — the transport of the bull colossi — and not as a rural scene of daily life, a vignette due merely to the impulse of the artist, without any natural connexion with the main topic of the picture.

On the other hand, the smaller scale in which the *šādūf* workers are rendered is hardly insignificant. The explanation may be, I think, that the scene represents a technical footnote explaining a detail in the landing of the bull colossi — an event which may conceivably have taken place ahead of, or during some earlier stage of the scene shown in the main picture.

The stone blocks for Sennacherib's bull colossi were carved in quarries at Balaṭai (now Eski Mōṣul) and Tastiate; of the latter we only know that it was located on the west bank of the Tigris[61]. Here the colossi, roughly hewn, were put on rafts and ferried to their destination, the South West Palace at Nineveh; the transport and the toil in getting them ashore is described by Sennacherib in the following terms (quoted from the Octagonal Prism B.M. 103000; CT 26, 1–37, v 64–78):

64 ^{d}KAL×BAD ^{d}KAL.MEŠ *ša* ^{NA_4}*pi-i-li pi-ṣe-e*
65 *i-na* ^{URU}*Ta-as-ti-a-te ša e-bir-tan* ÍD.MAŠ. GÚ.QAR
66 *ib-tu-qu a-na mu-kil* KÁ.MEŠ-*ši-in*
67 *a-na šu-pu-uš* GIŠ.MÁ.MEŠ
68 *qí-rib* GIŠ.TIR.MEŠ GIŠ.MEŠ GAL.MEŠ
69 *ú-qí-ru i-na nap-ḫar* KUR-*šú-un*
70 *i-na* ITU.GUD UD-*mu a-dan-ni e-de-e pa-an šat-ti*
71 *i-na* GIŠ.MÁ.MEŠ *ṣi-ra-a-te*
72 *a-na a-ḫa-an-na-a ú-šeb-bi-ru-ni mar-ṣi-iš*
73 *i-na ni-bir ka-a-ri* GIŠ.MÁ.GU.LA.MEŠ
74 *ú-ṭe-eb-bu-ú ba-ḫu-la-te-šú-un*
75 *ú-ša-ni-ḫu ú-lam-me-nu ka-ras-si-in*
76 *i-na da-na-ni ù šup-šu-qi*
77 *mar-ṣi-iš ú-bi-lu-nim-ma*
78 *ú-ša-aṣ-bi-tu* KÁ.MEŠ-*ši-in*

"Lamassus and *šēdus* of white limestone they[62] quarried at Tastiate, on the other side of the Tigris, to flank their[63] gates; for the construction of ships they felled[64] large trees in the forests of their entire country. In the month of Iyar, at the time of the spring flood, they brought them across to this side with difficulty in 'tall' ships. In the passage to the harbour[65] they grounded the big ships; their crews exerted themselves and embittered their minds, (but) under strenuous labour they brought them (ashore) with difficulty, and let them take possession of their gates." Armas Salonen, who quotes the lines 64–75 in his book Die Wasserfahrzeuge in Babylonien (Studia Orientalia 8/4 [1939]; Salonen's source is a parallel text B.M. 118819, published ibid., Pl. II [photo] and pp. 181 ff. [transliteration]), 42, translates: "In der Hafenfurt aber war der Tiefgang der grossen Schiffe allzu gross und

stets daran zu erinnern, dass selbst nach der Entstehung der perspektivischen Zeichenkunst in Griechenland die Verkleinerung entfernter Figuren sich zu allerletzt eingestellt hat."

61. Balaṭai and Tastiate. ^{URU}*Ba-la-ṭa-a-a* (CT 26, 1–37, vi 62 and 78); for references see Luckenbill, Annals of Sennacherib, 191 s. v. Balatai. A town ^{URU}*Ba-la-ṭi* is mentioned in L. W. King, Babylonian Boundary Stones 108, ii 16; a town ^{URU}*Ba-LAṬ* in C. H. W. Johns, Assyrian Deeds and Documents No. 960, i 18. The name of the city of Tastiate occurs only twice, both references being from the inscriptions of Sennacherib: CT 26, 1–37, v 65, and Bull Inscription line 9, see Luckenbill, Annals, 118.

62. I.e., prisoners of war referred to previously.

63. I.e., the gates for which they were destined (?).

64. Verbal root *qur* II "to fell (trees)".

65. For the terms *kāru* and *nēbiru* see A. Salonen, Nautica Babyloniaca (Studia Orientalia 11/1 [1942]), 35–40. The determinative sign GIŠ (absent CT 26, 1–37, v 73), which Luckenbill indicates with *nēbiru* in the parallel passage, Bull Inscription 11 (Luckenbill, Annals 118), is not warranted in Layard's copy (Inscriptions, Pl. 38), which gives: *i-na*! *ni-bir ka-a-ri*.

(infolgedessen) wurden ihre Mannschaften (beim Rudern) ermüdet" (lines 73–75). The assumption that the boats, or rafts[66], carrying the stone blocks were moved by rowing is unfounded; for all slabs preserved of the sequence depicting the transport of the bull colossi on the river[67] indicate that the rafts were moved by towing. It is not very difficult to understand why rafts were used and this way of handling them adopted; for the load they carried was beyond the maximum capacity of the average river freighter as attested for the Neo-Assyrian and Neo-Babylonian periods[68], each bull colossus weighing 30 tons or more[69]. In translating the verbal form *uṭebbū* as "they grounded" I disagree with Salonen in his rendering "der Tiefgang war allzu gross," and with Luckenbill who translates: "the large boats went down" (Ancient Records 2, § 384). While *ṭebū* in the First Form (*qal*) means "to sink (vb. intrans.)" and "to draw much water; to have great draught"[70], the Second Form (*pi'el*) means "to sink (vb. trans.); to ground", in accordance with the well known principle that the form II_1 of intransitive verbs has a transitive causative meaning[71].

An interpretation which would seem to explain the peculiarities of picture and text, as far as I can see, has so far only been hinted at once.[71a]

66. GIŠ.MÁ.MEŠ *ṣīrāte* (line 71) and GIŠ.MÁ.GU.LA.MEŠ (line 73) apparently both denote the rafts on which the bull colossi were ferried; cf. Salonen, Wasserfahrzeuge 46. Difficult is the suffix *-šun*, line 74, as *eleppu* is here evidently of feminine gender (*ina eleppēte ṣīrāte*, line 71); cf. Salonen, op. cit. 11, note 2.

67. The series of slabs depicting in bas-belief the transport of bull colossi to Nineveh was discovered by Layard at Kuyunjik in the Gallery XLIX, continuing into Court Yard VI where most of the slabs were standing. Their interrelation has been examined by A. Paterson, Palace of Sinacherib (1915), Analysis pp. 6 and 11, and C. J. Gadd, Stones of Assyria 170 f. and 250. Drawings and photographic reproductions are found mainly in the three following publications: Layard, Monuments of Nineveh 2 (1853); Assyrian Sculptures Arranged and Annotated by A. Paterson (published by H. Kleinhaas & Co., Haarlem, Holland; without year [ca. 1900–1908]); and Paterson, Palace of Sinacherib.

Towing of the rafts on the river is shown in Mon. 2, Plates 10 and 11 (reprinted Pal. of Sinach. 87), in two fragments of the sequence now in the Vatican (Museum Nos. 17 and 21; see G. Furlani and E. F. Weidner, AfO 10 [1935–36], 227), and in a fragment belonging to the Museo Civico of Como (Furlani and Weidner, AfO 11 [1936–37], 140 f.).

Scenes where bulls are hauled over land are published (respectively republished) as follows:

Mon. 2	Ass. Sculptures	Pal. of Sinach.
12	IC/C (detail) and CXIII/CXIV (photos)	25 (photo)
13	CXV/CXVI (drawing)	27/28 (drawing)
15	CXX/CXXIII (drawing)	32/33 (drawing)
16*	CX (drawing)	23 (drawing)
	XCVII/XCVIII (detail) and CXI/CXII (photos)	
		24 (photo)

* A fragment cut out of this slab is preserved in the Vatican (Museum No. 2); see Furlani and Weidner, AfO 10, 226.

A further fragment belonging in the sequence is now in the Istanbul Museum (Asariatika müzeleri 416), mentioned by Gadd, Stones 226.

68. See the computations of Salonen, op. cit. 158–160 (Die Leistungsfähigkeit der babylonischen Frachtschiffe), according to which the maximum capacity for average freighters of this period was around 15 t.

69. When intact, the Winged Bull from Khorsabad, now in the Oriental Institute (Museum No. A 7369), weighed over 30 t (Khorsabad 1 [OIP 38; 1936], 44). The problems of moving the bull colossi faced by the ancient technicians can be gauged from Gordon Loud's chapter The Winged Bull, Khorsabad 1, 42–55, dealing with the shipping of this monument from Iraq to U. S. A. in the year 1933.

70. *ṭebū* "tiefgehen", see Salonen, op. cit. 49, note 2.

71. Principle formulated by A. Poebel, Studies in Akkadian Grammar (AS 9 [1939]), 5 note 1 and p. 69. Examples of *ṭebū* II "to sink (trans.), to ground" in Codex Hamm. §§236–238, 240; MAOG 5/3, 31 obv. 17; AJSL 35, 140 b (Th. 1905-4-9, 10–12), line 16; AKA 176, 12; 186, 17; 209, 17; 220, 17; 387, 136. Salonen, in Nautica Babyloniaca (Stud. Or. 11/1 [1942]), 99 f., posits an intransitive causative meaning "tiefgehen lassen" for *ṭebū* II_1, based on the present Sennacherib passage, which he then translates: " 'sie (i. e. die steinernen Statuen) liessen aber die grossen Lastschiffe in der Hafenfurt tiefgehen' (d. h. der Tiefgang der Schiffe war wegen der schweren Statuen zu gross, so dass die Besatzungen beim Rudern ermüdet wurden)."

71a. B. Meissner has suggested that the water drawn may have been used to lubricate the sledges and rollers in order to lessen the friction of the woodwork (Grundzüge der babylonisch-assyrischen Plastik [Der alte Orient 15; 1915], p. 128). But it would hardly have been necessary to have a series of *šādūfs* in a somewhat intricate arrangement, when water could just as easily be fetched from the river in an ordinary bucket and carried

In Assyrian Sculptures Arranged and Annotated, Parts VIII/IX (ca. 1908), p. 20, A. Paterson uttered his very justified doubts as to the validity of the traditional view on the rôle of the *šādūfs*: "At the foot of the slabs is seen the river Tigris and an island, or, perhaps the tongue of an island at the confluence of the Tigris and the Khauser[72] (which meet opposite Kuyunjik). On it are three hand-swipes (well-sweeps) or *shadufs*. The beams of the *shadufs* with a heavy stone fastened at one end, and a rope with a bucket at the other, are each balanced upon a tower of masonry, in front of which is a brick platform, upon which men work the apparatus by dropping the buckets into the water. A conduit to carry off the water thus drawn, is not visible. Or perhaps the men are baling water out for the construction of a pier or river-wall to protect the future palace, or they may be reclaiming land, by drainage, to extend the area of the mound".

As seen by Paterson, the labourers are undoubtedly baling water for some purpose other than irrigation. The clue to the nature of their occupation may well prove to be the verb *uṭebbū* "they grounded." However, the explanation which I propose in the following is, of course, only a theory. The procedure of grounding the rafts, which I believe was an intentional act, made up for the shortcomings of harbour accommodations and was accomplished with the *šādūfs* by baling water into tanks(?) to the left of the walls of brickwork on which the workmen are standing. The space behind these walls can hardly represent anything but tanks (note the higher level of the water dammed behind them), which means that this part of the drawing can best be compared to an architect's profile drawing. In the first edition of his Von ägyptischer Kunst (1919), Heinrich Schäfer rejected this interpretation: "Natürlich ist auch in dem Bilde . . . . . kein Gedanke an einen wirklichen Schnitt, so schwer es uns Erwachsenen heute wird, ihn nicht darin zu sehen. Ebenso bei den Staumauern der assyrischen Darstellungen des dem ägyptischen ganz ähnlichen Schadufs (Schwengelschöpfwerks) . . . unten links vor den Schwengelpfosten" (p. 225, Anm. 67 a); but the rejection has not been repeated in the later editions (3rd edition, pp. 127 ff., on assumed "profiles"), and I see no other possible explanation.

The grounding of the rafts resulted from the lowering of the water level in a harbour basin, which seems to be shown in the bas-relief; a small bay or the area demarcated by a sand bar (which appears as a narrow strip of land above the water) may have served as such. Separated from the main water course, the basin could be drained following the entering of the rafts; and with the rafts firmly grounded in this early version of the dry dock the dock workers could begin unloading the stone blocks and getting them on their way with the help of levers, props, rollers, and gangs of slaves. Afterward water was probably let back into the basin, whereupon the dock was ready to receive the next consignment delivered from the quarry. It is not unreasonable to assume that special harbour works were constructed for the specific purpose of serving the rafts and freighters conveying the building materials for the new palace of Sennacherib.

Several points remain obscure, however. It is still difficult to see, for instance, why two men should be necessary at the higher level, when only one is occupied at the lower. Moreover, there are indications that Layard's drawing is incorrect in certain details; for a later drawing

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to the place where it might be needed. In an Egyptian picture of the transport of a colossal statue (reprinted H. Schäfer, Von ägyptischer Kunst [3rd edition], Abb. 221, p. 236), a liquid is being poured out in front of the statue; whether for the purpose of lubrication or as a libation, is uncertain (cf. Erman-Ranke, Ägypten und ägyptisches Leben, p. 568). In some cases water was manifestly used as a lubricant to facilitate the transport of Egyptian colossal statues; this is borne out by the following references which I owe to Mr. Henrik R. Baumann: for the Old Kingdom, see Pierre Montet, Les scènes de la vie privée dans les tombeaux égyptiens de l'Ancien Empire (1925), 387 f. (the expression *stt mw* "pouring of water" occurring in the explanations accompanying representations in art), and, for the New Kingdom, G. Wilkinson, Manners and Customs of the Ancient Egyptians (3rd edition [1847]), V 421 f. with Fig. 502. For the (Middle Kingdom) representation referred to above (Erman-Ranke, Äg. 568), see also Percy E. Newberry, El Bersheh, I 20a and 25a with Pls. XII and XV.

72. I.e., the Ḫusur (modern name Khosr). I cannot here discuss the complicated question of the Tebiltu river in relation to the Ḫusur and the Tigris (cf. Olmstead, History of Assyria, Map 8 [p. 327]; R. C. Thompson and R. W. Hutchinson, A Century of Exploration at Nineveh [1929], 122 note 1 and Plan 1; and the following passages from Senncherib's inscriptions quoted according to pages in Luckenbill, Annals: 96, 74 f.; 99, 48 f.; 105, 85–87).

made by Norman de Garis Davies (Tomb of Nefer-ḫotep at Thebes, Vol. I, Fig. 10, p. 73) shows the water to the left of the second set of *šādūf*s taking a sudden upward turn; and there are other discrepancies between Layard's and Davies' renderings in the appearance of masonry, water levels, and ground levels. An examination of the original monument might clarify some of these problems.

The extent to which the construction of canals and dikes depends on the presence of metal tools (picks, shovels, etc.) has not been investigated; but it is beyond any doubt, and amply attested for instance through the correspondance of Hammurabi of Babylon with the governors Sin-iddinam and Šamaš-ḫāṣir, that the cooperation of large groups of people needed for such social tasks as the digging and maintenance of irrigation canals and dikes was possible only under a strong central government. Under such circumstances the *šādūf* was probably rendered somewhat superfluous, at least in Babylonia and along the upper course of the Euphrates, which may explain the scarcity of references to it in Old Babylonian economic texts. Possibly, irrigation by means of the *šādūf* is referred to indirectly by Iaḫdunlim of Mari in the inscription published by F. Thureau-Dangin, RA 33 (1936), 49 ff.,

col. i 21 ff.:
21 *ḫi-ib-bi*
22 *ša* GÛ ÍD.UD.KIB.NUN.KI
23 *as-sú-úḫ-ma*
24 *ma-ti šu-ub-tam*
25 *ne-eḫ-tam ú-še-ši-ib*
26 *na-ra-a-tim*

ii 1 *ú-pé-et-ti*
2 *da-la-a-am*
3 *i-na ma-ti-ia*
4 *ú-ḫa-al-li-iq*

"Water-conduits[73] at the bank of the Euphrates I tore up, and I let my country dwell in peace(?); I opened (*petū* II_1; i.e. dug) canals (and) put an end to the (method of irrigating by) drawing water in my land (from the wells? or from the river?)." Is this an indication that the *šādūf* became outmoded in and around Mari already in the 18th century B.C.?

While the literary and artistic sources offer incontestable evidence for the presence of the *šādūf* in ancient Mesopotamia and Egypt, the evidence for the *nā'ūra*, or undershot water-wheel, is much less compelling. References to water-wheels in ancient Mesopotamia, found in handbooks and popular accounts, are for the most part based on the false assumption that the Akkadian equivalent of the logogram GIŠ.APIN was *narṭabu* and denotes an instrument for watering ("instrument for making moist"). Thus, when Olmstead writes, "The water-wheels in all Assyria were repaired" (History of Assyria 68; reign of Tiglath-Pileser I)[74]; "The narrative [of Tukulti-Ninurta II] continues with . . . the making of irrigation machines" (ibid. 80)[75]. "Something like half of the Harran census was under irrigation. The larger machines were operated by two, four, six, or even eight oxen" (ibid. 521)[76], or refers to "a serf expert in the use of the water-machines" (ibid. 523; time of the Sargonids)[77], the word "plough" (Akkadian *epinnu*, plur. *epinnētu*) should in all cases be substituted for "water-wheel" and "irrigation machine." The error committed in earlier Assyriological literature has been traced and disentangled by W. von Soden in his article "Bezeichnet $^{giš}apin$ im Sumerischen auch ein Bewässerungsgerät?" (Orientalia, N.S. 16 [1947], 169–171). (For *epinnu* "gutter; wall ledge, etc." see L. Oppenheim, Orient. NS 19 [1950], 138 note 3).

When the numerous instances where the

73. *ḫibbu* "water-conduit," from a verbal root *ḫabābu* (III_1 "to irrigate", see Delitzsch, HWB 266; Jacobsen, Aqueduct 33; and Schott, ZA 42 [1934], 101). Cf. Sargon, 8th Campaign line 208 [with ZA 34, 144] and Esarhaddon Prism [R. C. Thompson, Prisms of Esh. and Ashurbanipal; 1931], vi 34. *ḫibbu* would seem to be a synonym of *terdītu* (note 34), possibly also of *šummannu* and *ziriqu* (both of which, however, are made of wood), see p. 14. A closely related term is *miḫḫu*, see L. Oppenheim, Orientalia, N.S. 17 (1948), 37 note 4.

74. Statement based on the annals of Tigl. I, vi 101 f. (AKA 88).

75. Based on the annals of Tuk.-Nin. II, rev. 50 (V. Scheil, Annales de Tukulti-Ninip II [1909], p. 26 [§8]).

76. Olmstead's source for the description of the district of Harran in the Neo-Assyrian period is C. H. W. Johns, An Assyrian Doomsday Book or Liber Censualis (1901), in particular Johns' chapter "The Arable Land" (pp. 18–20). The fifth tablet of ḪAR.*ra* = *ḫubullu*, which lists the plough and its parts (and also enumerates ploughs with teams varying from two to eight oxen), has been used by Olmstead in B. Meissner's edition, AOTU 1/1 [1916], 18 ff.; see especially pp. 33 f.

77. After Johns, op. cit. 77, s. v. *erēšu*.

logogram GIŠ.APIN was misrepresented as denoting an irrigation instrument have been eliminated, few examples of the genuine *narṭabu* (logogram: SÛN)[78] remain; some are collected by von Soden, l.c. 169[79]. As suggested by A. Deimel, Liste der archaischen Keilschriftzeichen (Die Inschriften von Fara, 1 [WVDOG 40; 1922]), No. 389, the sign SÛN probably represents a vessel; *narṭabu* "dürfte demnach eine zur Feldbewässerung benutzte Kanne oder vielleicht auch eine Tonne gewesen sein" (von Soden, l.c. 170), and is certainly a wrong track in our pursuit of the water-wheel.

The fifth tablet of the series ḪAR.*ra* analyses wooden objects which are all of a comparatively complicated nature, namely: the carriage, the plough (followed by related agricultural implements such as the harrow and the rake), the door and the lock (bolt), an irrigation apparatus, and, as the concluding section of the tablet, the loom.

The lines dealing with the irrigation apparatus (290–297) run:

ḪAR.*ra* 5,	290	[*giš*].*a*.DUL+DU	x[ ]
	291	[*giš.a*].DUL+DU	y[ ]
	292	[*giš.a*].DUL+DU	x[ ]
	293	[*giš.* 'x.*maḫ*	[ ]
	294	[*giš.* x. *a*'.GAR	[ ]
	295	*giš*.(x).*a.nag.e*	[ ]
	296	*giš.gàr.ba*	[*kar-ru*]
	297	*giš.kak.gàr.ba*	[*sik-kàt* "][80]

Only two terms are clear: the "water-hoist" (lines 290–292[81]) and the "irrigator" (line 295). The circumstance that "knobs" (*karru*) and "nails, pegs (*sikkatu*) of knobs" were apparently parts of the latter, together with the general picture of the context in which the irrigation apparatus is listed (following the door and its parts), would seem to render the assumption likely that a sluice is described in the present lines of ḪAR.*ra* 5. The knobs, attached by their nails in holes at either side of the sluice, may have held in place the lock-gate which could be moved up and down, thus forming a valve by means of which the flow could be stopped or regulated. There are indications that a sluice which fits this description at one time existed in the Wadi Bastura tunnel of Sennacherib, where the peg holes in the side walls of the stone structure can still be seen[82]. When the description of

78. Note that SÛN = *narṭabu* also denotes "a mash produced by pouring a liquid over crumbled or pulverized substances" (L. Oppenheim, On Beer and Brewing Techniques in Ancient Mesopotamia According to the XXIIIrd Tablet of the Series ḪAR.*ra* = *ḫubullu* [in cooperation with L. F. Hartman; Supplement to the JAOS, Number 10, December 1950], p. 48 note 67).

79. An unsolved problem is still the letter VAT 7006 (VAS 16, 179), in spite of an emendation of the lines 13–19 by P. Kraus, MVAeG 36/1 [1932], 180 f. In transliteration the letter reads: (1) *a-na be-lí-ia qí-bí-ma* (2) *um-ma* LÚ.^{d}NIN.GAL(? or SI_x?).AN.NA-*ma* (3) ^{d}UD *ù* ^{d}AMAR.UD *aš-šu-mi-ia da-ri-iš* UD-*mi* (4) *li-ba-al-li-ṭú-ka* (5) *i-n*[*u-ú*]-*ma ya-ar-ka-at* A.ŠÀ-*lim* (6) GUD.ḪI.A *ù bi-tim ša i-ḫa-al-li-qú-ma* (7) *la ta-pa-ar-ra-su mi-nam-mi* (8) *a-na-ku mi-nu-um-ma-mu-ia ša ta-ta-ka-lam-ma* (9) *pí-ir-sú́m ra-bu-um ip-pa-ar-ra-su* (10) *ù ḫi-ṭi-tu i-na* A.ŠÀ-*im* (11) *i-na la ma-aṣ-ṣa-ar* ḪU BI KI ⌜x y⌝ (12, Edge) *ra-bu-um ib-ba-aš-šu-ú* (13) [*ù a-d*]*i* UD.10.[KA]M (14) [x *i*]*š-tu šu-ri-pí-tim* (15) *an-ni-a-tim* (Rev. 16) *mu-ši-ta-am* SÛN.ḪI.A *ta*?-[*q*]*u*?-*ú* ḪU.ḪI.A (17) *ka-la* UD-*mi-im* (18) A.ŠÀ-*am a-na* [*me*]-*e* x (19) *uš-ta-li-a aš-tap-ra-kum* (20) [x y]-*um ra-bu-um ib-ba-ši* (21) [x x x x]-*ma* (22) *it*-[x x x (x)] *ṣú-ḫa-ru* (23) *a-na bi*-x[x x x -*q*]*i-du-ni* (24) A.ŠÀ-*ka na*-[vacat?]-*di* (25) ⌜a⌝-*nu-um* ŠAR QAR DA? [x x x (x)] (26) *ša-al-m*[*a*] *ki-ma mi-nu-ut* (27) *ka-an-nim ša še-im* (28, Left edge) ⌜x⌝-*ḫu-um iz-za-az-zu li-iq-bi-kum* (29) A.ŠÀ *la i-ḫa-al-li-iq* (30) 10 TUR.TUR.MEŠ UD.10.KAM (31) *an-ni-a-am* (32) *a-na 2 qa* ŠE.TA.A.AN (33) *ù 1 qa* ZÚ.ḪUM.TA.A.[AN] (34) *li-in-na-ag-ru-ma* (35) A.ŠÀ *li-še-zi-bu* (36) ⌜*ù*⌝ *ki-ir-ba-nam li-il-qú-*⟨*tu*⟩

In view of the fact that damage by birds has been done due to negligence in watching a (newly sown) field, Landsberger is probably right in thinking that also the *iṣṣūrātu* (ḪU.ḪI.A) of line 16 denote injurious birds ("Schädlinge"; Die Serie *ana ittišu*, p. 166 note 1), in spite of Kraus' suggestion that these "birds" might denote some irrigation apparatus (MVAeG 36/1, 181) — a suggestion which is particularly tempting in view of the analogous Arabic term *'aṣfūr*, for which see later, p. 25 (*'aṣfūr* denoting various pegs in the modern Egyptian *sāqia* and plough).

šurīpētim (for expected *šurīpātim*) of line 14 is "periods of frost"; the verb of line 16 (read by Kraus *iq*[!]-*qú-ú*) is doubtful. Lines 18 f.: "letting the field rise above the water", i. e. lowering the water level over the irrigated field so that the earth emerges. *uštālī* (for classical Old Babylonian *uštēlī*) an indication for a South Babylonian origin of the letter.

80. For the sources cf. JCS 5, 32 note 96. Ad line 295: uncertain whether a sign is missing between giš and *a*.

81. For DUL+DU (Sumerian e_{11}) and its Akkadian equivalents see A. Deimel, ŠL 459, 25 (cf. UD+DU = *è*, ŠL 381, 251, and Meissner, AOTU 1/1, 23 note 4).

82. Photo published in the Arabic section of Sumer 3/1 (1947), Plate 5; cf. Fuad Safar, l. c., p. 25 of the English section. For other references to the Wadi Bastura tunnel of Sennacherib see JCS 5, 29, with notes 66 ff.

the sluice is preceded by an account of an irrigation apparatus, there seems reason to believe that this is an undershot water-wheel, powered by the water as it flows through the passage under the lock gates behind which it was stored up.

As the right column is not preserved, the Akkadian terms for the sluice and the water-wheel cannot be established with certainty. However, it seems a fairly safe guess that one Akkadian equation of the logogram *giš.a*.DUL + DU was *mušēlū*[83]. Possibly, another equation was *sūru* (attested mainly in the Neo-Babylonian period[84]), a word for which the meaning "water-wheel" has been suggested by Ungnad[85]; this translation is, however, doubtful and should perhaps be abandoned in favour of a rendering "low-lying area; hollow"[86]. A third candidate is the word *šiknu*[86a], a rather vague term which seems to have the meaning "machine" in two letters from Hammurabi, both of which are addressed to Šamaš-ḫāṣir, governor of Larsa. One is published by Thureau-Dangin, Lettres de Ḫammurapi à Šamaš-Ḫâṣir (TCL 7 [1924]), as No. 39, and translated by him RA 21 (1924), 32 f. The other is found in G. R. Driver's publication, Letters of the First Babylonian Dynasty (OECT 3 [1924]), No. 2 (Pl. II; translation p. 2). In transliteration and translation, the pertinent lines of the letter TCL 7, 39, read: (10) *a-na pí-i* ÍD.UG.GIM.DU (11) *al-ka-ma* (12) *šum-ma mu-ú ma-ṭú-ú-ma* (13) A.ŠÀ GÚ.UN-*šu-nu mu-ú la i-ka-aš-ša-du* (14) *i-na pí-i* ÍD.UG.GIM.DU-*im* (15) *me-e te-er-di-tam šu-uk-na-šu-nu-ši-im* (16) *šum-ma mu-ú ša i-na-an-na* (17) *i-na* ÍD.UG.GIM.DU *i-il-lam* (18) *la i-ṣú-ú ma-la* A.ŠÀ GÚ.UN-*šu-nu ru-ub-be-e-em* (19) *ma-ṣú-ú* (20) *mi-im-ma ši-ik-nam* (21) *i-na pí-i* ÍD.UG.GIM.DU (22) *la ta-ša-ak-ka-na* "Go to the mouth of the river U. and, if the water is 'low' and does not reach (the level of) their rented field, erect a water conduit for them at the mouth of the river U.! If the water which is now in the river U. should rise (and) not be scanty, but satisfactory (for the irrigation) of their rented field, do not erect any machine at the mouth of the river U.!" A very similar situation is found in the letter OECT 3, 2: (4) *šum-ma mu-ú a-na* UD.UNUG.KI *ù* ŠEŠ.UNUG.KI (5) *it-tab-šu-ú* (6) *i-na* KÁ ÍD.ḪI.A (7) *ša aq-bu-kum* (8) *ši-ik-nam la ta-ša-ak-ka-an* (9) *šum-ma mu-ú a-na* UD.UNUG.KI (10) *ù a-na* ŠEŠ.UNUG.KI (11) *la ib-šu-ú* (12) [*í*]-*na* KÁ ÍD.ḪI.A *ša aq-bu-kum* (13) *ši-ik-ni šu-ku-un-ma* (14) [*m*]*u-ú-ma* (15) [*a-n*]*a* UD.UNUG.KI (16) [*ú a-na*] ŠEŠ.UNUG.KI (17) *li-ib-ba-šu-ú* "If there is water for Uruk and Ur, do not erect a machine at the mouth of the rivers which I mentioned to you. If there is no water for Uruk and Ur, erect machines at the mouth of the rivers which I mentioned to you, and may water then be provided for Uruk [and for] Ur!" The function of the machine, *šiknu*, seems to be raising of the water level, a sort of amplifier in the canalisation system whereby a current was produced (cf. Thureau-Dangin, RA 21, 32 note 3). If so, however, the *šiknu* must have required a power source and cannot be identified with the *nā'ūra*; but the letters are held in terms too general to allow any conclusion as to the exact nature of the structure.

As a fourth possibility for the water-wheel, a term *dalbu* was suggested by Sidney Smith (RA 21 [1924], 81), an identification which was upheld hypothetically by the excavators of Ur in connexion with a structure found in the sanctuary E-gibar (see e.g., C. J. Gadd, History and Monuments of Ur [1929], 239). The text on which Smith's suggestion was based (YBT 1, No. 45, i 34), has been corrected by Böhl (Symbolae . . . Koschaker, 164 and 174 f.), whereby the word *dalbu* was eliminated (read *at-ta-aḫ!-ṭa-al-ma* for *at-ta-ṣi da-al-ba*).

It remains to investigate a document from the Middle Assyrian period (VAT 8854 [KAJ 128]; reign of Tukulti-Ninurta I, approximately 1260–1232 B.C.), on the basis of which E. Ebeling has postulated an early occurrence of the *čerd*

83. As a terminus technicus for the plough, *mušēlū* is listed earlier in the tablet (Meissner, AOTU 1/1, 23 lines 66 ff.).

84. SanNicolò and Ungnad, Neubab. Rechts- und Verwaltungsurkunden 1 (1929–35) Beiheft (= Glossar) 139, s. v. *sūru*, and 62 f. (s. v. *ḫarru* [cf. Nachtrag, p. 170]). See also N. Strassmaier, Die Inschriften von Nabonidus (1889), 990, 7 and O. Krückmann, Neubab. Rechts- und Verwaltungsurkunden (TMH 2/3 [1933]), 17, 11.

85. A. Ungnad, NRVU 1, Glossar 139.

86. Cf. the ancient name of Samarrā, *Sur-marrati* (e. g. Harper, Letters 530, 8, with A. Sachs, in JAOS 56 [1936], 404).

86a. Note CT 19, 17: K 4386 [Group vocabulary] i 37 *a-lá id-da* = *ši-kin na-a-ri* (Sum. "water-raiser of a river" = Akk. "*šiknu* of a river").

(Akkadisch *bakrâtu* - Rad einer Bewässerungsmaschine, Orientalia, N.S. 20 [1951], 13 f.). The crucial point is a word ^{GIŠ}ḪU-*ra-tu* (lines 2 and 10), which Ebeling proposes to read ^{GIŠ}*bak-ra-tu*, and connects with the Arabic term *bakra*. From the fact that the object is described as having 17 "steps" (*kibsu*, line 3) and has been lost in the river (lines 12 f.), Ebeling concludes that it was probably a type of water-wheel which resembled the later treadmill.

As we have seen from Dowson's description (quoted p. 9 f.), *bakra* is a term which in the modern Arabic dialect of Iraq alternates with the term *čerd*. Essentially, however, *bakra* denotes the pulley wheel over which the haulage rope is passed[87]; only by a synecdoche is it applied to the entire machine ("pars pro toto"). When Ebeling thinks that the Arabic word is borrowed from his Akkadian candidate (l.c. 14), we may object that (1) Ar. *bakra* is a singular (feminine gender to *bakr*; Lane, Lexicon 1/1, 240 b), whereas ^{GIŠ}ḪU-*ra-tu* is a plural (line 2: *1-ni-a-tu* ^{GIŠ}ḪU-*ra-tu*; lines 10–13: ^{GIŠ}ḪU-*ra-tu an-na-tu ša i-na na-ar-te ú-ḫal-li-qu-ú-ni*); (2) Ar. *bakra* does not denote a treadmill, or anything remotely similar to it; it has no "steps" [if, indeed, *kibsu* means "step" at all; "step," in the meaning of German "Trittstufe", is *ḫūqu* in Akkadian[88], whereas *kibsu* normally means "step, pace"; German "Schritt"] and is not in itself a water-wheel, but part of an irrigation machine, the essential components of which are bucket, rope, and pulley; (3) it is possible to explain the meaning of Ar. *bakra* "pulley (wheel)" as the result of an internal Arabic semantic development, whereas an explanation from Akkadian meets difficulties.

Ad (3), we may observe that by metonymy animal names are often used to signify tools, parts of tools, or mechanical devices, which have a resemblance to their zoological namesakes in appearance or function (cf. "cock," "ram," "horse"). In the Arabic dialects of Egypt parts of the *sāqia* are known under names like *ḥomār* "donkey", *ḫanzīra* "pig", *ġurāb* "raven", *quṭṭa* "cat", *harmīs* "lion"[89]. Of them *ġurāb* and *quṭṭa* together with *'aqrab* "scorpion" als denote specific parts of the Egyptian plough[90]. And *kalb* "dog" is used as a technical term for a variety of objects: "A piece of iron at the head of the pivot, or axis, of a mill. . . . A piece of wood by which a wall is propped, or supported. . . . A strap, or thong, cut from an untanned skin. . . . The nail that is in the hilt of a sword. . . . An iron at the edge of a camel's saddle . . .: a bent, or crooked, or hooked, iron, by which the traveller hangs, from the saddle . . . , his travelling provisions. . . . Anything with which a thing is made firm, or fast, or is bound"[91]. The word *'aṣfūr* "swallow" signifies pegs for many purposes; with regard to the *sāqia*, Littmann gives the following information: *'aṣfūra* "(Vogel), d. i. ein (kleines Stützholz mit einem) Loch, das sich in der Mitte des Querbalkens über dem Pfosten befindet, und sein Platz ist über dem Loch für die obere Zugstange. . . . Maḥmûd [L.'s informant] nannte auch Pflöcke am Pfosten und an der Zugstange *'aṣfūra*"[92]. *'aṣfūr* as a term for parts of the plough is also mentioned by Winkler (Äg. Volksk. 153 ff.).

bakra, then, would seem to have acquired its meaning as a technical term (cf. Dowson, quoted p. 9 f., and Lane's definition, quoted in note 87) by metonymy from *bakr*, fem. *bakra*, meaning "a youthful . . . camel; one in a state of youthful vigour" (Lane, Lexicon 1/1, 240 b), strength and carrying ability being the tertium comparationis.

The semantic parallels listed above render it unlikely that Ar. *bakra* is an Akkadian loanword. Analogous semantic developments do occur in Akkadian (e.g., *imēru*, see note 46 and *kalbatu*, see Delitzsch, HWB 328); but no such development is attested for the Akkadian word *bakru*, which is furthermore of an extremely rare oc-

87. E. W. Lane, An Arabic-English Lexicon, 1/1 (1863), 241 a: "*bakratu*" The thing upon which [passes the rope wherewith] one draws water . . . from a well [or the like]; . . . a round piece of wood, in the middle . . . whereof is a groove . . . for the rope, and in the interior [or centre] whereof is an axis upon which it turns; [. . . sometimes, by a synecdoche, it is used to signify a pulley complete]." Cf. B. Meissner, BA 5, 104 note 5: "*bakra*. Grosse hölzerne, aussen asphaltierte Rollen"; and H. A. Winkler, Ägyptische Volkskunde 159: "*bakara* Holzklötzchen (Dial. Nûb, Sanhûr)" (part of the Egyptian plough).

88. Landsberger, ZA 42, 166 note 4; AfO 10, 55 note 1.

89. E. Littmann, ZÄS 76, 45 ff.

90. H. A. Winkler, Ägyptische Volkskunde 153 ff. ('aqrab p. 159).

91. Lane, Lexicon 1/7 (1885), 2625 f.

92. Littmann, l. c. 48, No.'26; cf. p. 52 s. v. ("Achsenpfanne am oberen Ende des Pfostens").

currence. Of the two references which I can adduce, (a) Annals of Ashurbanipal (5 R 1–10), ix 65, and (b) Elihu Grant, Cuneiform Documents in the Smith College, No. 271, bis, only the former is reliable. But this is the passage dealing with Ashurbanipal's Arabian campaign, where *bakru* "young camel" may be a foreign word (cf. the following *suḫīru*). The Smith College text in line 5 reads *ba-ak-ru* ^{d}*Sin-ri-me-ni*, in line 11 *ba-ak-ru Li-pí-il-*^{d}*Sin*, both of which passages are doubtful; if translating "A young camel is S., L.", we merely make an a priori deduction from the meaning of the identical Arabic word.[93]

Returning to Professor Ebeling's suggestion with the preceding considerations in mind one will find, I think, that an identification of Akkadian ^{GIŠ}ḪU-*ra-tu* with Arabic *bakra* is unfounded. We had therefore better cautiously retain the transliteration ^{GIŠ}ḪU-*ra-tu*, and leave the problem of the word unsolved for the time being[94].

If we sum up the evidence after this survey of the most characteristic modern and ancient Oriental water works, we find that in spite of much which has been written to the contrary, only the *šādūf* is attested with certainty in the ancient Near East; that a winch seems to have been used for raising water from deeper wells in Assyria at the time of Sennacherib; while only slight indications for the presence of a sluice and water-wheel could be traced in lexical and other texts of the Babylonians. No basis was found in the present study for the theory that the ancient Babylonians and Assyrians employed the *čerd*, as has often been assumed. The *čerd*, then, seems to be a comparatively late invention, possibly made in Egypt, where perhaps it became obsolete with the introduction of the *sāqia*. This might explain the curious circumstance that the *čerd* is no longer to be found in Egypt, but in neighbouring areas to the west and east, countries which were outlying provinces of the Hellenistic civilisation centered in Alexandria, where it seems plausible to assume that the *sāqia* was invented.

93. *ba-ak/q-ru* perhaps represents *ṭaqru*; cf. RA 19 (1922), 23 note 1, and the personal name *Ina-Ekur-ṭaqrat* (Kassite period), written ^{SAL}*I-na-*É.KUR-*baq-ra-at* (A. T. Clay, Personal Names from Cuneif. Inscriptions of the Cassite Period [YOR 1; 1912], 88 b, and J. Stamm, Akkad. Namengebung [MVAeG 44; 1939], 229 with note 2). For *bakru*, *bakratu* as personal names (Clay, op. cit., 62 a), see Stamm, op. cit., 253, who translates "Jungtier." It may be of interest to note that also *suḫīru* occurs as a personal name once, in a document dating from the year 748 B.C., reign of Ashur-nirāri V (K. 326, rev. 12; 3 R 48, 1, republished Johns, ADD. No. 412); cf. Stamm, op. cit., 253 ("Kameljunges [?]").

94. Ebeling finds another occurrence in a broken passage of a Neo-Babylonian letter, CT 22, 55, 8 (see his Neubabylonische Briefe [Abhdl. d. Bayer. Akad. d. Wiss., Philos.-hist. Klasse, N.F. 30; 1949], p. 34, No. 55); l. c., 14.

AN ARABIC COGNATE OF UGARITIC *ǧmrm*

M. M. Bravmann

New York, N. Y., U.S.A.

A. Alt, in his article concerning Hebrew *hiṯ'ammer* (Vetus Testamentum, Vol. II, No. 2, April 1952, p. 153ff.), has convincingly demonstrated that the Ugaritic noun *ǧmrm* (masc. plur.), found in the list of persons published by Thureau-Dangin under the title Une tablette bilingue de Ras Shamra,[1] denotes the newly levied soldiers ("eine Bezeichnung der neu der Wehrpflicht unterworfenen," see loc. cit., p. 159). I would like to remark in this context that this meaning, derived by Alt from the composition of the list itself, may also be substantiated by an Arabic noun formed from the same root. The noun *ġumur* or *ġumr*, not infrequent in early Arabic poetry, possesses the meaning "inexperienced" (*wal-ġumuru 'llaḏī lam yuǧarribi 'l-'umūra*, see, e.g., the scholion in Mufaḍḍalīyāt, ed. Lyall, p. 143, 11), more exactly "inexperienced in war and fighting, tiro."[2] This may become evident from the following passages: *'In tarai šaiban fa'innī māǧidun * ḏū balā'in ḥasanin ġairu ġumur* (ibid., p. 143, 5; no. 16, 3) "Yea, if thou (o woman) seest hoary hair, yet am I a man covered with glory, a man with a fine fighting record, not one without experience."[3] *La'amruka 'innanī la'aḥū ḥifāẓin * wafī yaumi 'l-karīhati ġairu ġumri* (ibid., p. 639, 16; no. 95, 1) "By thy life! I am a man who defends stoutly his folk, no fighter unskilled in the day of trouble."[4] *'Amrun wamā 'Amrun biqaḥmin dālifin * ǰīhā walā ġumrin walā biġulāmi* (Naqā'iḍ Ǧarīr wal-Farazdaq, ed. Bevan, p. 645, 4) " 'Amr — and 'Amr is among them not decrepit, walking slowly (as one who carries a burden), and not an inexperienced one, a youngster." Furthermore, cf. *sa'alat Ḫassāna man 'aḫwāluhū * 'innamā yas'alu biš-šai'i 'l-ġumur* (Dīwān Ḥassān b. Ṯābit, ed. Hirschfeld, p. 67; no. 155, 3) "She asked Ḥassān who his maternal uncles (and cousins) were: Indeed, it is the one without experience that asks about the matter."[5]

Yet, it seems doubtful whether the meaning of the Ugaritic word, as indicated by Alt, is apt to shed fresh light on the Hebrew term *hiṯ'ammer* (Deut. 21, 14 and 24, 7).

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1. Revue d'Assyriologie, 37 (1940), p. 97ff.; col. I, l. 11, 33; col. III, l. 32.

2. The same sense is conveyed by the passive participle of the second conjugation, *muġammar*, as (see Brockelmann, ZDMG 91/1937, p. 375) 'Alqamah no. 25,5 (= Mufaḍḍalīyāt no. 119,5), Labīd no. 14,8, al-Balāḏurī, 'Ansāb al-'Ašrāf, V, 314,22 (the last a prose passage: *hāḏā min muġammarati 'l-ǧaiši*). Without doubt, all of these forms (*ġum(u)r*, *muġammar*), conveying the sense of "inexperienced in war", are to be connected with the active participles of the second and third conjugations, *muġammir* and *muġāmir*, "(a man) throwing himself with fury into the perils of battle" (with the finite verbs belonging to these forms conveying the corresponding verbal meaning). The meaning of these latter forms may easily be explained by connecting them with such expressions as *ġamarāt al-maut* "the depths (literally: the masses of water) of Death," or simply *al-ġamarāt* (as Mufaḍḍalīyāt p. 609,17; 677,5) as a metaphor for a perilous encounter. The unreasonably courageous who throws himself thoughtlessly into the danger of battle is normally not highly appreciated in early Arab conception, and this behavior is considered characteristic of the inexperienced tiro. The ("passive") state of "being inexperienced" may be considered a secondary derivation of the active behavior of the man plunging into the peril (*muġammir*, *muġāmir*), and thus the passive participle *muġammar*, or the ("neutral") verb *ġamura* "to be inexperienced" may be explained as transformations of the original "active" forms.

3. As against Lyall's rendering in his Translation of Mufaḍḍalīyāt, p. 49: "Yea, if thou seest hoary hair, yet am I a man still full of vigor for great and noble deeds, no bungler." Lyall has misunderstood the meaning of *ḏū balā'in ḥasanin*, which is the direct contrast of *ġum(u)r*.

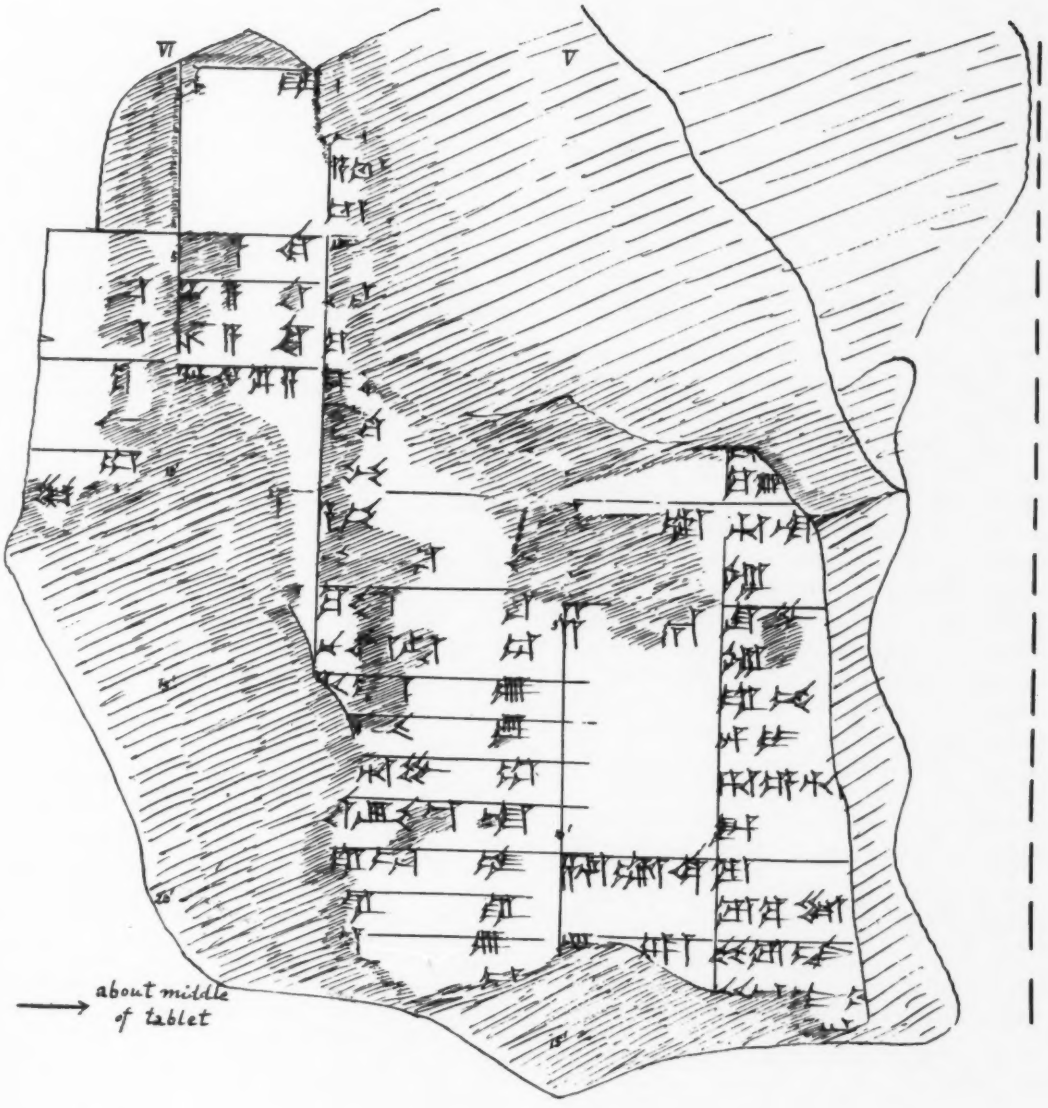
4. Lyall's translation, ibid, p. 267.

5. Read *yas'alu* instead of *yus'alu* of the text. In this quotation, too, *ġumur* means "inexperienced in warlike affairs", as is evidenced by the subsequent verse (ibid., v. 4): *qultu 'aḫwālī banū Ka'bin 'iḏā * 'aslama 'l-'abṭālu 'aurāti 'd-dubur* "I said (answered): My uncles are the Banū Ka'b (who hold their ground and do not flee) on the day the heroes 'betray their naked buttocks' " (i.e. on the day of utmost danger, when even seasoned warriors are wont to flee).

(13) MLC 2638. 125 x 128 mm.

Lower right quarter of a tablet belonging to an early version of *diri-watru*. As in the case of Nos. (7) and (8) (JCS 4 73ff.), the piece is here published to enable B. Landsberger to use it in his study on lexical series now in preparation. Copied by A. Goetze.

MLC 2638



LÉON LEGRAIN: Business Documents of the Third Dynasty of Ur. (Ur Excavations, Texts III. Publications of the Joint Expedition of the British Museum and of the University Museum, University of Pennsylvania, Philadelphia, to Mesopotamia). Plates. London, 1937. 207 plates. Indexes, Vocabulary, Catalogue, Lists. London, 1947. 288pp.

Tablets of the Third Dynasty of Ur are known to us in large numbers and come chiefly from Lagaš (Tello), Ṣilluš-Dagan (Drehem), Umma (Jokha) and Nippur[1]. Legrain's volume — the third in the series of "Ur Excavation Texts" — presents us with about 1800 more tablets of this period, this time excavated at Ur, the capital of the dynasty and its empire. The bulk of the previously known material had ranged in time from the middle of the reign of Šulgi, the second king of the dynasty,[2] to the early years of Ibbī-Sīn[3], its last king. Both the earlier years of Šulgi — not to speak of his predecessor Ur-Nammu — and the final period of the dynasty after Ibbī-Sīn's fourth year[4] remained unrepresented. One might have hoped that Ur would compensate for this lack. With respect to Ur-Nammu and Šulgi this hope has, strangely enough, not been fulfilled; the later dates of Ibbī-Sīn, however, have indeed emerged on the new tablets[5]. Unfortunately their sequence is not immediately recognizable; its reconstruction constitutes an important problem posed by the publication (which its author understandably has not tackled).

The importance of Legrain's book rests on the presentation of a wealth of new material: about 1800 texts of economic content. This is the source material from which the economic history of the period must be reconstructed. Attention should be called especially to the tablets dealing with sacrifices[6] and the records illuminating the crafts of the metal and textile workers. An accompanying index volume — dated ten years after the text volume — contains[7] lists of personal names (pp. 3–35)[8], the names of gods (pp. 36–42),[9] geographic etc. names (pp. 43–57), a vocabulary (pp. 58–192), a descriptive catalogue (with interspersed comments largely of a lexicographical nature) (pp. 193–275), the occurring date formulae (pp. 276–279), and the necessary concordances of excavation and publication numbers (pp. 280–288). Its purpose is to make the text material better accessible to cuneiformists and non-cuneiformists alike.

Although the copies do not approach the neatness[10] in which other publication series excel they can be considered as reliable. Legrain brought to the task long experience which goes back to his pioneer study "Le temps des rois d'Ur" (1912).

With respect to the index volume the reviewer, grateful though he is for the collected references etc., must regretfully state that it fulfills its purpose very imperfectly. Its most vital part, the vocabulary, does not represent the present stage of our knowledge[11]; in consequence the

1. For a full list of publications see A. L. Oppenheim, Catalogue of the Cuneiform Tablets of the Wilberforce Eames Babylonian Collection . . . (Amer. Oriental Series 32, 1948) 215–24. Important additional material can be expected when the Oriental Institute publishes the inscriptions excavated at Tell Asmar; see at present OIP 43.

2. For his dates note the article of F. R. Kraus, Orient. NS 20 (1951) 385–98.

3. When writing the name without hyphens there is no point in reproducing the archaic orthography in which the name is spelled; write throughout Ibbī-Sīn.

4. The order of the first four years is established by U 3677, formerly RA 30 121 and now Legrain 1230.

5. Their formulae had already been published in UET I, from which they were recorded in Ungnad's article "Datenlisten" in RLA.

6. See Lambert, RA 44 (1950) 73–87.

7. The volume strangely contains no table of contents.

8. No attempt is made to distinguish between Sumerian, Akkadian, West-Semitic and other elements. Noteworthy additions to the list of early Ḫurrian names are *Taḫ(i)š-atal* and *Taḫa-šen*. The apparent name *ḫu-un-tu-úḫ-li* may be suspected to conceal a Ḫurrian nomen professionis.

9. Neither *ia*, nor *ibi*, *na-bi* and *ma-at* (p. 41f.) are theophorous elements.

10. Edges and dividing lines are neglected (with occasional exceptions like No. 1554); the shading of broken passages often lacks necessary care. Precise quoting is impaired by the omission of line numbers.

11. In numerous cases the vocabulary is not con-

summaries of the descriptive catalogue can be used only with utmost caution. The less said beyond that the better. It might have been better to release the text volume upon completion than to keep it stored away for ten years (including the war years!).

The deficiencies which I felt it my duty to point out seem to me the result of excessive specialization. Even a group as large as the Ur III texts cannot, and must not, be understood in a vacuum. If an interpretation is attempted, steady attention must be paid to modern lexicographic studies (both in Sumerian and in Akkadian); if one aims at an appraisal from the point of view of political, economic and general cultural history — and this certainly must be our goal — then familiarity with the present stage of historical research is needed.

Cuneiformists are accustomed to the necessity of re-assembling "archives" by observing the proper names of the chief actors that occur in their tablets. Tablets from methodical excavations like those published by Legrain should make it superfluous to engage in time-consuming investigations of this kind. The excavation records must tell what was found together and where under what circumstances. It is incomprehensible that this vital information is withheld from the interpreter; it should be furnished as soon as possible.

It would be an interesting task to work out, using the new material and with due consideration to the old, the terminology of the metal and textile workers who figure so prominently in the volume. In doing so, careful attention would have to be paid to the series *Ḫarra-ḫubullu*, its "Vorläufer"[12], and related tablets like Scheil's "Vocabulaire pratique"[13]. Legrain's vocabulary affords only scant help. E.g. under the heading *urudu* "copper" (p. 182ff.) there are thrown together without any differentiation copper objects, qualities of the metal, and quantities of the metal used for definite purposes[14] or received from individuals[15]. Any number of corrections might be offered; there is space here for only a few examples. Read, e.g., ^{urudu}*šen*[16] instead of *alal*[17], ^{urudu}*gag* instead of *dù*[18], ^{urudu}*gìr.gub* instead of *gìr.du*[19, 20]; (*urudu*) *ig* is non-existent since the passage offers at best [*urudu* . . . . . ^{giš}]*ig*[21]. A few remarks on the names of garments may also be attached here. E.g. read ^{túg}*aktum* instead of *túg-a-zu*,[22] ^{túg}*á-gu$_4$-ḫu-um*[23] instead of *túg á-gud-ḫu-um*,[24, 25] *túg.guz-za* (or *ḫuz-za*)[26] instead of *túg-lum-za*. For *túg-da-zabbar*, certainly no garment — see Gudea, Cyl. B XIV 15[27] —, at least TÚG-*da.zabbar* should be substituted. The entry *túg-ḫa-um giš-gu-za* is certainly identical with ^{túg}*ḫa-bu-um.^{giš}gu-za* BIN IV 296 37; Crozer 21 5 (unpublished). And *túg-sagšù*[28] is to be changed

sistent with itself. The same passages may appear transcribed in various ways, and the references given are not always complete (and frequently faulty).

12. Published in Chiera's Sumerian Lexical Texts and elsewhere.

13. RA 18 49ff.

14. Marked by x-*šè* or *mu*.x-*šè*.

15. E.g., (amount of) *urudu / mu*-DU / *ki.dam-gàr-ra-ne-ta* "(amount of) copper, delivery from the *tamkarrū*" quoted as — (i.e. *urudu*) *ki-dam-gàr-ra-ta*.

16. ŠL 8; cf. K 8676 (B. Meissner, Sppl. 15*); Voc. prat. No. 406ff.

17. ŠL 317.

18. The same sign reads *gag* when meaning "peg", *dù* when meaning "make".

19. Akk. *gir(i)gubbûm*.

20. The same passage is quoted once more with the senseless reading (*urudu*) *mu-è*, i.e. MU.UD.DU.

21. Incidentally *má-da-lum* is obviously borrowed from the Old Akk. equivalent of later *mēdelum* "lock" (note the characteristic *má* for *m* + *ā*).

22. BM 81-4, 28 10 (JRAS 1905 behind p. 829) rev. 25. This is certainly not a "doctor's garb" as Legrain seems to think.

23. See B. Meissner, Beiträge 1 7f.; A. L. Oppenheim, Eames Collection 65 fn. 81; W. F. Leemans, Ishtar of Lagaba 11f.

24. Occasionally in the "catalogue" also spelled *á-gud ḫu-um* and explained (see p. 265 ad No. 1531) as containing *ḫu-um* = *ḫum* (LUM). Is the hyphen, elsewhere placed by the author after *túg*, omitted on purpose? This hyphen grows scarcer toward the end of the *túg* list; what is the principle, if any?

25. The *túg ba*-TAB.GAB-*ḫu-um* which is commonly associated with the *aguḫḫum* occurs in Umma and Nippur texts likewise. For the former cf. passages like BIN V175 3f.; Kenrick 67 (= Jean, Šumer et Akkad. LXXVII: 54) rev. 2 (after baking and cleaning!) and certainly also An.Or. 7 155 5 (is the copy correct?), and for the latter TMHC I/II obv. 1f.; 238 12; 242 obv. 5, 9, 11. In the "Vocabulaire pratique" it is no doubt to be restored as No. 34 following ^{túg}*á-gu-[ḫu-um]* No. 33. The correct reading of the complex TAB.GAB remains to be ascertained.

26. A. L. Oppenheim, Eames Collection 65.

27. Thureau-Dangin reads ^{urudu}*zi(d)-da-azag*.

28. Why the accent?

in the light of *e-a* = *nâqu* (Landsberger) l. 302 which offers for U + SAG the value SAG-*du-ul*.

To proceed to something constructive I should like to offer here a few observations of a chronological nature. It is usually stated that tablets cease in Drehem and Jokha with Ibbī-Sīn's fourth year.[29] One may have to extend this a little, namely on the assumption that the dates

bád ba-dù[30]

and

ús-sa bád ba-dù[31]

refer at least in part to the dates (a) and (b) to be quoted presently.

In Nippur and Lagaš three additional dates, now certainly ascribable to Ibbī-Sīn, occur, namely:

(a) *bád.gal.Nibru*^{ki},*Urim*^{ki}*-ma ba-dù-a* (BE III 133 17ff.)

(b) *ús-sa bád.gal.Nibru*^{ki},*Urim*^{ki}*-ma ba-dù* (BE III 133 20ff.)

(c) *Tu-ki-in*-PA-*mi-ig-ri-ša,dumu.sal.lugal ensi*$_x$*-Za-ab-ša-li*^{ki} *ba-an-tuku* (BE III 135 and RTCh 404, Reissner TT 237, 248, 276).

These dates of Ibbī-Sīn — and no other ones — are also found on (unpublished) Isin tablets. Limiting myself to the "archive" of a certain Lugal.sag$_8$(-ga) I can quote the following numbers dated to a string of years of Ibbī-Sīn:

(1) NBC 7148, 7754;
(2) e.g., NBC 5602, 5607, 5609, 5683–7, 7414, 7521, 7600, 7628;
(3) e.g., NBC 5600, 5606, 5777, 6392, 6394, 6437, 7755;
(4) NBC 5610, 7753;
(a) NBC 5689;
(b) NBC 5668, 5775, 5788;
(b+) *ús-sa bád mu.ús-sa-bi* (e.g., NBC 5599, 5666, 7072, 7200, 7718;
(c) NBC 5658, 5660, 5661, 5690, 7750.

29. A glance at the lists in N. Schneider, Die Zeitbestimmungen . . . p. 37 is sufficient.

30. Cf. N. Schneider, Die Zeitbestimmungen . . . sub Šulgi 35 B i and Šū-Sīn 4 B k.

31. Ibid. Šulgi 36 d and Šū-Sīn 5 o.

It is significant to recall that these tablets were acquired in a large lot which covers the whole reign of Išbī-erra and the beginning of Šu-ilišu's.[32]

Still another archive, acquired together with the "Isin" tablets of the Nies Collection and recognizable by the "Leitperson" Tūram-ilī (*tamkarrum*) and a special set of month names, has the following range:

Šū-Sīn

2+: NBC 7793;
3: NBC 7777;
5: NBC 7776;
7: NBC 7762;
8: NBC 7764, 7785, 7804;
9: NBC 7757, 7769, 7771, 7778, 7781, 7788;

Ibbī-Sīn

1: NBC 7148, 7754, 7758;
2: NBC 7765, 7766, 7770, 7774, 7775, 7786, 7795;
3: NBC 7138, 7755, 7767, 7768, 7779, 7780, 7787.

It seems proper to conclude[33] (1) that the dates marked above (a), (b), (b+), (c) — either in this sequence or with (c) at the beginning — must be immediately attached to the initial group Ibbī-Sīn 1–4, thus leading up to Ibbī-Sīn 7, (2) that the power of Ibbī-Sīn begins to wane after his fourth year and is still more reduced after his seventh year, (3) that in Isin, after Ibbī-Sīn 7, dates of Išbī-erra were used.

From the date list UET I 292[34] it is also clear that Legrain's numbers "24", "23" and probably "15" (with another date between "24" and "23") come toward the end of Ibbī-Sīn's reign. Most of the remaining dates should come between the initial group of date formulae and this more or less final one

Yale University A. GOETZE

32. Stephens, RA 33 (1936) 10ff.; V. E. Crawford, JCS 2 (1948) 13ff. (and a forthcoming volume in the BIN series).

33. Cf. similarly Falkenstein, ZA NF 15 75ff.; JAOS 72 41f.

34. See Crawford, JCS 2 (1948) 16ff.

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